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New York Subway Work. THREE weeks ago we stated that an arrangement was being made by which the electric light companies would have control of their own subways. The statement was contradicted at the time, but is now shown to be substantially true, for the licensed company has publicly declared its willingness to waive its exclusive contract to that extent. We believe that this is as it should be, but there now appears a possibility that in the new "deal" the East River and Manhattan companies will be completely shut out, so that without subways and without power to operate overhead, their plant, worth at least $1,000,000, would be absolutely unproductive. This would be a shameful injustice, and we trust that it will not be attempted or successful.

White Lead by Electricity. THOUGH the principal commercial application of electrolysis has thus far been confined to the deposition of pure metals, indications are not wanting that the functions which this powerful agent can perform are not to be confined to their present limits. We have on more than one occasion referred to the innumerable combinations and diversity of products which can be attained by this method, and said that it required but systematic investigation to bring the process to its full development. As a step in the direction noted, the description given in another column of a new electrolytic process of white lead manufacture will, we hope, serve to arouse new interest in this subject. As the inventor truthfully remarks, the cost of the current is by no means an insurmountable obstacle to commercial success, and, as in the case described, the by-products may be sufficient to counterbalance entirely the fuel item.

Thermo Batteries. THE generation of electric current directly from coal or fuel is now apparently sought in the direction of thermo-magnetism, as a solution. This seems by no means to have discouraged those who have worked on the thermo-electric properties of metals. As the latest work in this direction we place before our readers the thermo battery of Herr Gülcher, which evidently possesses some novelty in construction, but in which the results obtained are probably due more to what is saved thereby in gas than by what is gained in the use of the new secret antimony alloy.

Small Motor Improvements. THERE is no more interesting phase of the progress made in the application of small electric motors than the tracing of the comparison between the class of machines designed for this purpose a few years ago and those of to-day. The former, though supplying a demand, were in many cases modifications of the older types adapted to new conditions, and lacked the essential qualities of efficiency and durability. To-day, on the contrary. as exemplified in the new Crocker-Wheeler constant potential motor, described in another column, by strict adherence to sound electrical principles, together with correct mechanical construction, small electric motors are placed on an equal footing with those of the largest sizes. The addition of a means for varying the speed of these small machines without impairing their efficiency is another step in the direction of progress which cannot fail to be appreciated. The attention now being paid to small motors is further exemplified in the Riker motor, shown and described also this week in our columns.

Electric Range Finding. THE arts of war have within the last decade drawn largely on the science of electricity for their improvement, and the results already accomplished are proof of the fact that much is still to be done in that direction. The introduction of the dynamo and electric motor on board warships has already to a certain extent begun to change methods long in vogue, and others now rapidly developing are destined to have a marked influence. Among these, we are confident, is the electric range finder of Lieut. Bradley A. Fiske, of which we present a full description to our readers, and which for simplicity and accuracy is almost ideal in its adaptation to the work to be accomplished. By making the resistance of a length of wire correspond with the arc of a circle traversed by a line telescope, an observer is able to ascertain the exact range of a distant object and to inform the gunners accordingly. This obviates entirely the errors generally made in judging distances, especially in the heat of an action, and must insure more hits than are counted on at present.

Kansas City Notes. OUR Western correspondent, Mr. F. DeLand, furnishes this week a most interesting sketch of the history and growth of Kansas City, and of the cordial manner in which electrical ideas and applications have been welcomed in that wonderful Southwestern centre of trade and commerce. Kansas City having been so quickly and so shrewdly appreciative of the benefits that electricity can confer on a community, it was well deserving of a visit from the National Electric Light Association, and President Weeks is entitled to hearty thanks on both sides for the introduction he has thus effected. It is not the least of the efforts he has made for the promotion of the industry with which he is connected and the welfare of the community in which he dwells. We are glad to add to what Mr. DeLand says, and to the various advices on the subject of transportation, hotel accommodation, etc., the announcement that the Commercial Club of Kansas City will give the Association a reception on the evening of Feb. 11, affording the visitors an opportunity to meet the representative men of the city.

The Electrical "Afreet." WHILE a large number of newspapers and journals have given themselves up to the belittling and misrepresenting of electrical applications, there have been some noteworthy exceptions. In fact, those even who at first were so eager to say an unkind word about electricity have now changed their tone and treatment, but none the less they made a poor exhibition while engaged in their modern witch crusade. As an example of clear-headed, sober, fair discussion of the subject, we print in this issue, from Mr. Julian Ralph's bright new paper *Chatter*, an excellent article on "The Electrical Afreet," in which, seconding the efforts of another brilliant journalist, Mr. Joseph Howard, of the New York *Press*, the writer shows how wild and absurd the whole agitation against electricity has been. Mr. Ralph's paper should find a friend and subscriber in every electrician, if only as some little acknowledgement of the manly, convincing way in which he breasts the stream of prejudiced opinion, and shows how clean a record electricity has, even in these her early days of imperfection and experiment. Our oft-repeated arguments may, perhaps, go for those of a special pleader, but at least they find confirmation in his unchallengable statement that "On the whole, the electric afreet does not appear to be a sanguinary monster, for the figures show that electric energy is absolutely safer than any similar quantity of energy used in the industries of the country."

What is Magnetism. NEXT to the solution of that great question, What is Electricity? there is certainly none more important and interesting than that concerning the true nature of magnetism. The systematic quest for the solution of this problem has given rise to many theories. With the progress of modern research however, many of these older theories fall to the ground, being insufficient to explain the new phenomena discovered. In taking up this question in his inaugural address, as president of the English Institution of Electrical Engineers, Dr. Hopkinson shows to what comprehensiveness a sufficient theory of magnetism must attain in order to explain all the observed phenomena which he marshals. Dr. Hopkinson, for good reasons, inclines to Weber's theory of magnetism, according to which every magnetic body is made of molecular magnets in indiscriminate positions, but which are directed in a uniform position by a magnetizing force. Among the phenomena pointed out, that of the peculiar behavior of the alloy of iron and nickel presents a most fruitful source of investigation, which, it appears, might be turned to practical advantage in some direction.

Electric Light and the Eyes. AN item has been going the rounds to the effect that a St. Louis doctor had made serious charges against the electric light as hurtful to the eyes. His gloomy vaticinations were as follows: "No eye can sustain the glare of the electric light that now meets the gaze everywhere. It is ruinous to the sight, and induces paralysis of the eye. Any defect in the eye is readily transmitted to children, and we can easily see what weak and unhealthy eyes people will have after the electric light has been at work upon several degrees of ancestors. There is no good reason why a spectator in a theatre or ball should have to look at an electric light, or past one in fixing his eyes on the stage, and yet this is what he must do now and then. Nor should one read or write by the electric light. The only light the eyes will stand healthfully is a soft lamp light." This is highly amusing to electricians, and seems to have proved so to Western doctors and oculists. One of them says that the St. Louis man is an owl, and advises him to go back to his tallow dip. Another says "the man is crazy." A third remarks: "I have never heard of any special optical disease resulting from the new light, and am quite sure there cannot be any, because, as I have said, the electric light is a pure white light, 'softer' and more agreeable to the eye than a lamp or gas." We note that the alarmist statement that we quoted first is making a splendid record, and is being served up as "Science," or "Science and Industry," "Scientific Notes," or "Science Gossip," in about 130:59 papers per diem; and we have some curiosity to see how many years it will take the truth to catch up to it. In the meantime we await the early appearance of a sensational article on the subject in the New York *World*, with "thrill" headlines, telling how many people are struck blind daily by the electric light and have to be carried home by their friends.

Safety in Electric Lighting. HAVING published the article on the "Dangers of Electric Lighting," by Mr. Edison, and later the reply thereto by Mr. Westinghouse, the *North American Review* for February publishes an article by Sir Wm. Thomson relating to the same subject. As the articles written respectively by Messrs. Edison and Westinghouse might by some be considered to be written from the partisan standpoint, the discussion of the question by Sir Wm. Thomson, under the head of "Electric Lighting and Public Safety," may be looked upon as the utterance of an independent judicial authority. At the very outset, Sir William Thomson inveighs against the senseless objections raised to overhead wires on aesthetic grounds, and likens them to cirrus clouds as compared with the dense volumes of smoke constantly pouring from thousands of chimneys. The same people, he remarks, would complain of a forest of ships' masts seen from London Bridge, or completing the vista of some broad avenue of New York, or relieving the dullness or squalor of some little city by the sea—if ships were an invention of this century and the shipping industry were not fifty years old. Sir William then points out that outside of England, America and Italy, there is only one city in which overhead high-tension circuits are used, and that is at Temesvar, in Hungary. Passing, however, to the actual question of safety, Sir William cites the rules of the Board of Trade, and shows that though they are in a certain sense tautological, their proper fulfillment will insure safety to human life and from fire. While admitting, of course, the danger attached to unprotected high-pressure circuits, Sir William is of the opinion that in cities economy of maintenance would dictate running underground, rather than simply the impossibility of making them safe overhead. For the country, Sir William thinks that the Board of Trade rules might even be largely relaxed, so that, indeed, bare copper conductors properly put up and secured might be run in country districts with perfect safety. The article is well calculated to show that electric high-tension current can be run with safety, and that if ordinary measures of security are adopted no danger need be feared on that account.

NEW BOOKS.

Traite Elementaire de l'Energie Electrique. Vol. I. By E. Hospitalier, Paris, 1890. G. Masson. 608 pp., 6 × 9¼ inches.

As the number of elementary treatises on electricity is by no means small, the appearance of an additional one would ordinarily require no special mention; but in this case the author has certainly placed before the student matter which, if not in itself new, is treated in a novel, attractive and rational manner, enabling the student to grasp at once not only the principles involved but their practical application as well. It will be noted that the author has called his work a treatise on electric energy, in contradistinction to electricity generally, and it is from this standpoint that the subject matter is treated. Such a work must necessarily, even in its elementary character, contain some mathematical discussions; but, as the author remarks, formulæ are merely the simple numerical relations between different values which enter into the calcutions. They represent true physical equivalences. Symbols fix these formulæ and engrave them on the mind, and permit their co-ordination to be better understood.

The author introduces the subject by an excellent chapter on the units and physical constants upon which the C. G. S. system is based, but relieves it of the dryness usually accompanying such chapters by explaining the methods of measurement actually adopted and the instruments used for that purpose. He then takes up the general subject of magnetism and magnetic action, treating of the magnetic field, magnetic induction and terrestrial magnetism, in which he introduces the various factors which influence magnetism, such as temperature, the methods of magnetization, etc. Electro-static induction forms the subject matter of the second chapter, in which the theory of condensers, capacity and the potential energy of electric charges is thoroughly discussed.

With Chapter III. the author takes up the electric current, beginning with the law of Ohm, and following this out by a thorough treatment of the electric current and its dynamic actions, which leads him naturally to the system of the electro-magnetic C. G. S. units now universally employed. These are followed by chapters on resistances, and galvanometric and electrometric measurements, in which all the latest instruments and their methods of use are illustrated and described. The author then takes up the subject of what may be called theoretical electric generators; that is to say, he discusses electric generators in the abstract, treating both of the continuous current and the alternating types, and shows how they may be employed for the various purposes of measurement. Then are taken up in succession the measurement of capacities by means of the absolute condensers, by the ballistic method, and the relations between the electrostatic and electromagnetic C. G. S. units. The contact phenomena and electro-chemistry form the subject of a chapter, in which the general laws on these subjects are well brought out and their application illustrated by examples of actual apparatus. The electro-thermic properties of the current are also treated of separately, and the latest work in this connection summarized. The following six chapters may be said to be devoted to the electro-dynamic phonomena, beginning with the law of Ampère, and following out the subject by the treatment of electro-dynamometers, the measurement of periodic currents, etc. Electromagnetic induction, including self-induction and mutual induction, is here treated of in an admirable manner, and the methods of calculating the various quantities involved are given. The volume ends with a chapter on a number of miscellaneous subjects, including electro-static induction machines, pyro-electricity and electro-optics, and gives a brief outline of the modern views as to the identity of electric, magnetic and luminous phenomena as developed by Hertz, Lodge and others.

Though methodical in its treatment, as becomes a successful professor of long standing, the work is written in the fresh, and, we had almost said, vivacious style which characterizes all the writings of M. Hospitalier. Throughout the book but a single type of notation is employed, so that the student is able to follow out each subject without being confused with a diversity of symbols, several of which may refer to the same thing. We can heartily recommend this book to the student, and await with pleasure the appearance of the second volume, which will treat of the industrial applications of electricity. The two together will undoubtedly constitute a valuable compendium of the modern science and practice of electricity. The present work is excellently got up, is well illustrated, and contains a very full index.

Practical Notes for Electrical Students. Vol. I. By A. E. Kennelly and H. D. Wilkinson. The Electrician Printing and Publishing Company, Limited, London, 1890. 308 pp., 6 × 9 inches. Price, $2.50.

Of the numerous reprints by which electrical literature is now being rapidly augmented in various departments, there is none which has greater *raison d'être* than the volume before us. Though the articles of which this volume is constituted originally appeared in the London *Electrician* under the title of "Letters for Learners and Unprofessional Readers," the character of its contents is such that it may be safely placed in the hands of more advanced persons than those ordinarily included under the above title. The names of the authors are a sufficient guarantee that the contents of the volume are both accurate and practical, and, indeed, there is hardly an experimental fact recited which is not accompanied by the result of actual measurement made in order to exemplify it. The introductory chapter, treating of the laws, units and simple measuring apparatus, is well calculated to induct the reader at once into the correct principles underlying the elementary nature of electricity and to convey a knowledge of the action which goes on in the generation of electricity by the chemical battery. The subject of batteries is then taken up more in detail, the various types of cells are described and illustrated, and their chief advantages and disadvantages brought out. The authors then take up the question of electromotive force and potential, which they describe, with special reference to the chemical cell. These are followed by excellent chapters on the resistance of conductors, and the relation between various conductors in this respect, and several practical problems are worked out illustrative of the principles described. The electric current is then treated of, with reference to telegraph signaling both on the open and closed circuit system, the various phenomena of retardation met with, both on subterranean and submarine lines, are discussed; the chapter ends with a description of the practical units of current, quantity, etc., and the method of calculating the strength of the current by Ohm's law, in which the practical examples given will aid the reader considerably.

Chapter VI. treats of current indicators, their general uses, and the manner of their construction. This is followed by a number of very simple tests which can be made with this class of instrument for continuity, the detection of faults in telegraph and similar apparatus, in detecting the identity of wires bunched in cable form, insulation and other tests. The calibration of current indicators occupies a chapter by itself, and here are described in very simple

The Riker Motor.

terms the methods employed in this most important subject. This chapter is of the utmost value, as it places before the reader in simple language the most approved and easy rules for calibrating the tangent galvanometer, and various calibrations by comparison. The three final chapters of the book are taken up with the consideration of magnetic fields and their measurement. We can say without hesitation that the explanation here given of this subject, by many considered as abstruse, is such as cannot fail to absorb the attention of those even who are but slightly grounded in mathematics. This chapter contains a full discussion of the nature and properties of permanent magnetic fields, in which the unit magnetic force, the moment of a magnet, etc., are clearly defined. The application of the magnetometer to the measurement of such forces and the nature of magnetism are also discussed. This is followed by a thorough treatment of electro-magnetic fields, in which the permeability, electromagnetic induction, saturation, etc., are defined and illustrated by examples and diagrams. Finally the magnetic fields of coils and solenoids are taken up and their nature thoroughly discussed.

It has been the special aim of the authors to convey their meaning in the simplest language possible, and in this respect admirable success has been obtained. Though formulæ are necessarily and rightly included, they are of such a nature as can be readily understood by any one having an ordinary knowledge of algebra. The book is throughout illustrated by excellent engravings, and, as we have said before, will prove of the greatest value to every student, its special merit lying in its thoroughly practical tendency.

The Riker Electric Motor.

We have had occasion to describe several electric motors and devices of Mr. Andrew L. Riker, and now present to our readers the new motor designed by him and built by the Riker Electric Motor Company, of Brooklyn, N. Y. The machine which is illustrated in the accompanying engraving is of the consequent pole type, the pole pieces and base being all cast in one piece. These two castings are jointed together at the top and bottom by the field cores, which are of wrought iron, and are bolted to the pole piece extensions.

The lower core is somewhat longer than the upper, thereby bringing the centre of gravity of the machine very low. The lower field coil is inclosed almost entirely by the base, thus protecting it from injury. The field coils are wound on thimbles, and are slipped over the cores, so that if by any accident the coils are injured, it is only a matter of removing six bolts to effect a remedy.

One of the principal features of the machine is the armature, which is an improved Pacinotti ring. The slots are of a uniform width; in them is wound a flat copper wire, which completely fills the space. These armatures have been used for all classes of work and have proved themselves capable of withstanding the roughest usage without any signs of failure. With this type of machine the amount of copper has also been reduced to a minimum, there being only 20 pounds of wire on a 2 h. p. motor.

The machines, which are shunt wound, run at an almost constant speed, there being a difference of about one per cent. between the full load and no load. They are supplied with self-oiling bearings and other devices of improved design. Recent tests of the ½ h. p. machine are claimed to have shown an efficiency of 83 per cent., after a 10 hours' run.

Manufacturing White Lead by Electricity.

Many attempts have been made to substitute electrolytic methods for the purely chemical ones in the manufacture of a variety of products, but thus far few have come into general use, due perhaps to lack of perseverance rather than to the impossiblity of achieving the desired results. It is, therefore, with considerable satisfaction that we are able to bring to the attention of our readers a process for the electrolytic production of white lead, recently patented and put in practical operation by Mr. Turner D. Bottome, of Hoosick, N. Y.

The process devised by Mr. Bottome consists in electrolytically dissolving a lead electrode in an electrolyte containing nascent or free carbon dioxide, whereby the lead compound formed by electrolytic action is precipitated to form hydrated carbonate of lead, or pure white lead, which is then removed, washed and dried.

The manner in which this is accomplished is as follows: The electrolytic solution is prepared by dissolving in the proportion one-half pound each of sodium nitrate and ammonium nitrate to one gallon of water, and then saturating the solution thus formed with carbon dioxide, which can be done in various ways. Sodium carbonate and ammoninm carbonate may be used in the place of the nitrates; but in that case nitric acid must be added until the bath is about neutral, which results in the larger portion of the carbon dioxide being driven off during effervescence. The electrolytic solution is then placed in a tank and electrodes of metallic lead are immersed in the same. The electrodes are then connected to the generating dynamo, and a current density of about 15 ampères per square foot of anode surface is maintained. Upon the passage of such a current between the electrodes through the bath the white lead begins to fall very rapidly. As the carbon dioxide is taken up from the bath to form the hydrated carbonate of lead, it is, of course, necessary to have the bath replenished with additional carbon dioxide as the process continues. This can be done in several ways. A convenient way in doing this consists in burning limestone, washing the gas produced by the disassociation of the constituents of the limestone, and supplying the gas directly to the bath.

Where the electrolytic solution is made up of sodium and ammonium nitrates in water, and the solution is saturated with carbon dioxide in its free state, the reactions taking place upon the passage of the electric current, according to the inventor, are as follows: The bath is decomposed, yielding at the anode nitrogen pentoxide, ozone, and oxygen, and at the cathode sodium hydrate, ammonia, and hydrogen. The lead is attacked by the powerfully-oxidizing nitrogen pentoxide (N_2O_5) and ozone; but nitrogen pentoxide in the presence of water is decomposed and forms nitric acid (HNO_3). During the double decompositon which takes place nitric acid (HNO_3) and plumbic acid or hydroxide of lead, $PbO(OH)_2$, are formed. The nitric acid combines with the free ammonia and sodium hydrate to again form sodium and ammonium nitrate, while the plumbic acid is precipitated by the free carbon dioxide present and forms finally the hydrated carbonate of lead, $2PbO, CO_2 + Pb(OH_2)$. Thus it is seen that although the solution is decomposed by electrolysis, it is regenerated by the chemical reactions taking place, and the only loss sustained is carbon dioxide and water, which can be readily supplied.

The white lead is from time to time removed from the tank, washed, and dried, and on mixing with a suitable vehicle into a paint it is found to have much greater covering properties than ordinary commercial white lead formed by dissolving lead in acetic acid in the presence of carbonic acid, since the latter is slightly crystalline and less opaque than the hydrated carbonate produced by the action of carbonic acid on plumbic.

The first question raised on any invention in electrochemistry is this: "Is it not cheaper to do the same thing by mechanical or chemical means?" But upon looking into this matter closely, one finds that the mere cost of electricity for separating or dissolving metals is comparatively slight. Mr. Bottome's calculations on this point are as follows:

Lead is dissolved at the rate of 59.52 grains per ampère hour, and if the dissolved lead is caused to combine with

FIG. 1.—GIBBS RAILWAY LAMP.

some element before deposition takes place it will add to its own weight that of the element. Thus lead in combining with water and carbon dioxide gains 19.88 per cent., or nearly 20 per cent. Hence one ampère hour forms 71.35 grains of pure white lead. The counter E. M. F. of the white lead bath is from $\frac{30}{100}$ to $\frac{1}{4}$ volt, so that the $\frac{1}{2}$ volt is required to operate one tank; one watt hour will then deposit or form 142.7 grains of white lead, or 15.2 pounds per horse power hour, or 152 pounds a day per horse power, or 27½ tons per year. Figuring power at $55 a year, 50 cents a ton for the electric current would cover the making of white lead. The cost of the water entering in combination is nil, and that of the carbon dioxide also, because 575 pounds of lime rock evolve 230 pounds of the gas at a cost of 100 pounds of hard coal, leaving a by-product of 345 pounds of quicklime, which more than pays for the coal; while the 230 pounds of gas just make 1 ton of white lead, 170 pounds of water also entering into combination with 1,600 pounds of lead to form 2,000 pounds, or 1 ton.

The inventor has favored us with a specimen of this interesting product which is in an extremely fine state of

FIG. 2.—GIBBS RAILWAY LAMP.

division, the result of a simple drying by spontaneous evaporation, in marked contrast to the white lead obtained by the old acetic acid process which has to be ground mechanically before it can be used.

Quick Service of Electric Motors.

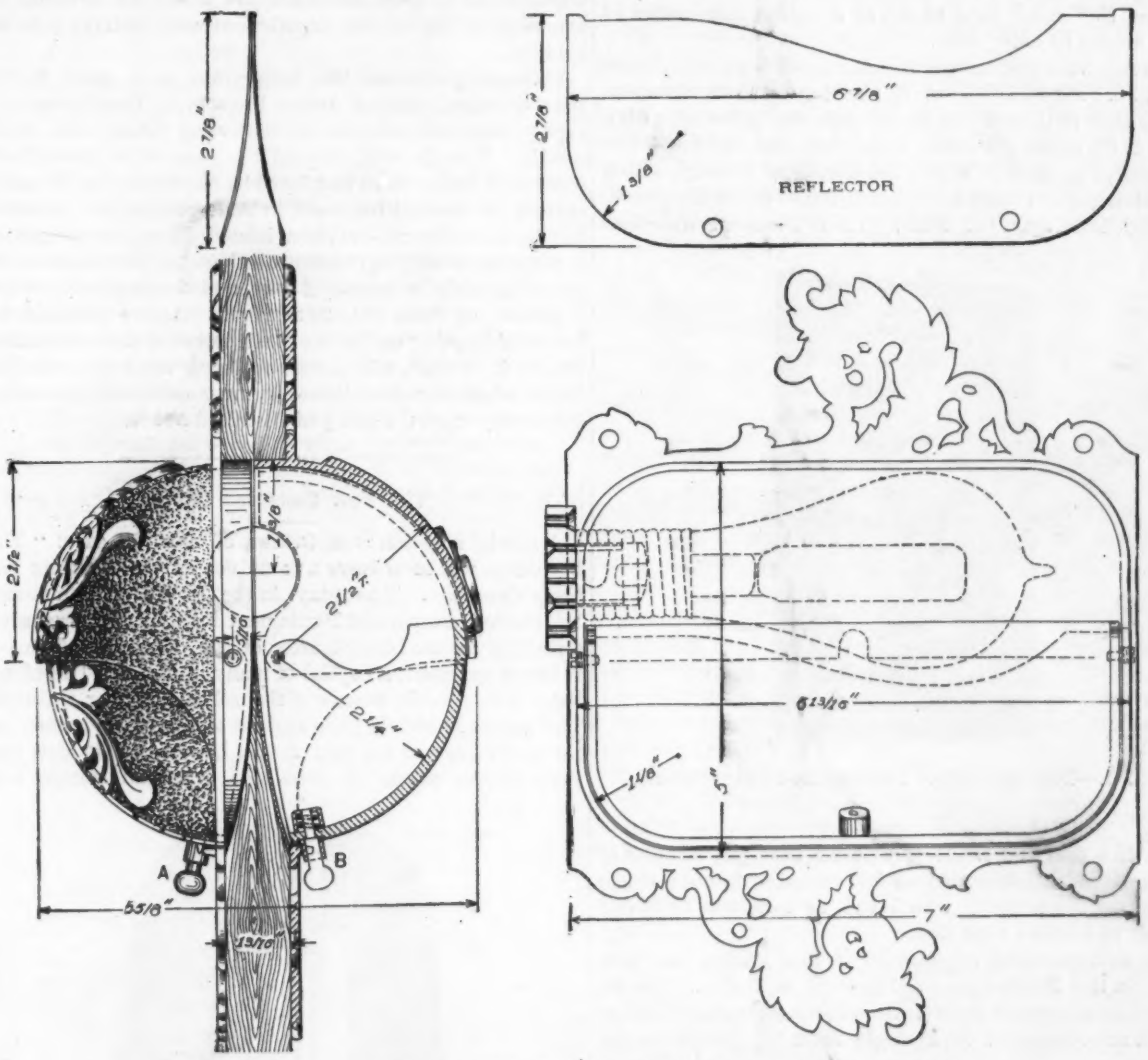
The printing department of the John Morris Printing Company started up as usual on Monday morning, says the Chicago *Industrial World* of Jan. 23, notwithstanding the complete wrecking of their engine and boiler by the explosion on Friday. Had they been obliged to wait until the new boilers could be set up and put in readiness and the engine overhauled and repaired, it would have caused a delay of fully a month, and the consequent loss in failing to fill their contracts on time, and the loss to employés by being thrown out of work for that time, would have been greater in money value than the loss caused by the wreckage.

As soon as the situation was fully realized, arrangements were at once made with the Thomson-Houston Electric Company to place a 40 h. p. electric motor in their building, and connect it with their shafting, so instead of a month's delay, one day's time was sufficient to make all changes.

Probably never before has the perfect adaptability of the electric motor to all cases where power is needed, been so thoroughly demonstrated as in this instance; a complete wreck of steam plant one day, depriving that busy establishment, with thousands of dollars worth of contracts in their hands, of power to operate its numerous presses, rollers, cutters and other machinery necessary in the printing business, and everything running perfectly a day later; and this speaks more eloquently than words of the superior advantages electricity offers over other sources of power. With electricity as motive power no skilled attendance is necessary, no danger of explosion or fire, and all concentrated within a space scarcely larger than a man could stand in, a point which is of no small consideration in places where every inch of floor is of value.

Electric Reading Lights for Railroad Cars.

The accompanying illustrations show one of the latest novelties in car lighting, and one that is proving a strong attraction to travelers, and a good advertisement for the Chicago, Milwaukee & St. Paul Railroad. It is a reading



FIGS. 3, 4, 5, 6 AND 7.—THE GIBBS LAMP FOR RAILWAY CARS.

and berth lamp, in connection with the system of electric lighting in use on that road. Its general appearance and location are well shown in Figs. 1 and 2. Its detail construction will be understood from Figs. 1, 2 and 3, which show elevations and section of the lamp and bracket; Figs. 4 and 5, which show a detail of the reflector.

The device consists of a small drum having two rotating shutters, shown at *A* and *B*, Figs. 4 and 5, which can be raised or lowered when desired to show or shut off the light. The electric lamp is fastened to one end of the drum, as shown in Fig. 3, and extends into it. Below the lamp is a double, beveled reflector, which throws the light outward, and effects an illumination of the seats on both sides of the partition without loss of light. The detail of the reflector, and its exact location, are easily understood from the drawing. The hood formed by the upper half of the drum is so arranged that it shades the light from the eyes of the passengers who are facing it, and it also serves as a reflector to cast light upon the book or paper in the hands of the passengers sitting under it. The total number of lamps per car is not increased by the use of this berth lamp, because a corresponding number is taken from the centre of the car.

Considerable attention has been devoted to the ornamentation of the bracket and the sliding cover, with the result of giving this device a graceful appearance, harmonizing with the general ornamentation of the cars on the St. Paul road, which has been the subject of particular study by that company.

The Electric Lighting Association of the State of New York.

This Association has been organized and the following officers elected: President, T. F. Nevins; first vice-president, C. R. Huntley; second vice-president, W. H. Browne; secretary and treasurer, E. A. Maher. Executive Committee, Mr. T. F. Nevins, Brooklyn; C. R. Huntley, Buffalo; W. H. Browne, New York; E. A. Maher, Albany; B. B. Odell, Newburg; J. J. Moore, New York; F. A. Cheney, Elmira; A. B. Smith, Poughkeepsie; Geo. A. Redman, Rochester.

Electrical Tanning in Persia.

Mr. S. G. W. Benjamin writes to the New York *Times* as follows:

"Whatever be the ultimate value of electricity as applied to the tanning of leather, the idea is by no means a new one. As I have already stated elsewhere, the Persians have for ages believed in the efficacy of electricity in the preparation of leather. For some five hundred years the tanners of Persia have excelled. No finer leather has ever been made than that which still exists on some of their antique book covers.

"It may not be generally known that the manufacture of the famous Russia leather originated in Persia, and some time ago a Russian merchant actually shipped to foreign parts a large invoice of leather as Russian which he had obtained in Persia.

"Now the Persian tanners have the notion that electricity is good for tanning, but as they have been, of course, entirely ignorant of modern scientific methods for obtaining or utilizing electricity, they have sometimes exposed their leather on high places, especially on Mount Elwend, near Hamadan. This they do precisely because such elevated spots are most exposed to electrical storms, and they affirm that lightning (or electricity) is a valuable agent in the curing of leather. However the idea originated, in either case the coincidence, if such it be, is curious, and perhaps worthy of mention in your columns."

Electric Lighting in Massachusetts.

The fifth annual report of the Board of Gas and Electric Light Commissioners of Massachusetts has just been presented. It shows that there are in the State 75 gas companies, of which 26 have the right to supply both gas and electricity, and no fewer than 100 electric light and power companies.

The number of public gas lamps continues to diminish in about the same ratio as last year, electric lights taking their places. The coal gas companies lost 999 lights.

The total income of all the companies was $3,869,342.11. The expenses were $3,314,337.98, leaving the net income $1,555,004.13.

The year was an active one for those engaged in the electric lighting business. There were 44 new electric light and power companies and 4 new companies for the manufacture of gas and electric light incorporated. The board

says there is a demand for a simple and economical means of testing the candle power and quantity of electricity supplied to consumers,

The demand for both gas and electric light is constantly growing, and the advance in electric lighting has been especially noteworthy. The following table shows the number of electric lights of various candle power in use in the state in 1888 and 1889:

Candle power	1888.	1889.
16	52,075	80,075
20	1,200	2,800
15	880	880
2,000	5,846	6,978
1,200	2,757	4,206
1,600	110	130
1,500		35
1,800		40
800		146

The Moennich Induction Telemeter.

In our issue of Dec. 7 last we described a novel induction telemeter devised by Dr. Paul Moennich, of the University of Rostock, Germany, in which the indications of a distant thermometer were obtained by an ingenious arrangement comprising induction coils and a telephone so connected that when silence in the telephone was obtained, the indications of the transmitting and recording instruments were identical. The instrument, shown at that time diagrammatically, is illustrated in perspective in the accompanying illustrations. Fig. 1 shows the transmitting instrument having the metallic thermometer *M*, the movements of which are transferred to the pointer *Z*, and at the same time to one of a pair of coils placed at right angles to each other.

The receiving instrument situated at the station is shown in Fig. 2. As will be seen, it also contains an induction coil similar to that of the transmitter and provided with a knob *k*, by which the small inner coil can be adjusted to the desired position. When the telephone through which the interrupted current is passing ceases to emit a sound, the indication upon the dial Fig. 2 is identical with that

Fig. 1.—The Moennich Telemeter—Transmitter.

upon the dial Fig. 1. It is evident that any number of transmitting instruments may be connected to but a single recording instrument, which can be switched from one circuit to another with ease.

The first practical application of this system has been made in the Friedrichshain Brewery in Berlin. The installation consists of seven transmitting instruments, all of which are connected to a single recorder placed in the office.

Gulcher's Thermo-Battery.

For some time past Mr. R. J. Gülcher, the inventor of the Gülcher dynamo, has been at work on the construction of a thermo-electric battery, and has, it is claimed, effected some decided improvements over existing types.

The principal novelty of the battery consists in making one or both of the thermo elements in the shape of a hollow body, instead of a solid, as heretofore. The hollow electro-positive electrodes of the Gülcher battery consist of chemically pure nickel tubes. Joined to these are the electro-negative cylindrical bars, which consist of an alloy of antimony, the composition of which is kept secret by the manufacturers.

Our illustration, Fig. 1, taken from the *Elektrotechnischer Anzeiger*, shows the thermo-battery in perspective and Fig. 2 its construction more in detail. As will be noted, a U-shaped channel resting upon the base is closed at the top by a slate slab, into which the nickel tubes are fixed in two rows. The top of these tubes is provided with a perforated collar of soapstone, so that the gas which passes up from the U-shaped channel is emitted from these perforations and heats the junction of the two metals directly above the perforators.

Above the soapstone collar there is a second one of brass, which protects that part of the antimony alloy connected with the nickel. The negative electrode, which rests on the top of the nickel tube, turns outwardly and downwardly, and is continued in a flat copper strip, which serves as a cooling medium and also as a connection to the next element. It will therefore be seen that each element has its own gas outlet and a separate heating flame. As the flames are very small, enough air can get at each flame to effect combustion in the same way as in the Bunsen burner, and as a consequence neither soot nor carbonic oxide gas is formed; thus the atmosphere is left uncorrupted when this thermo-battery is employed. At the same time the maximum heating effect of the gas is obtained.

Our illustration, Fig. 1, shows the arrangement of a 50-cell battery. The following data are given concerning the consumption of gas and electrical energy developed by the thermopile. The consumption of the battery amounts to about 8 cubic feet of gas per hour, or about $\frac{1}{25}$ of a cubic foot per element. Its E. M. F. is 4 volts and its internal re-

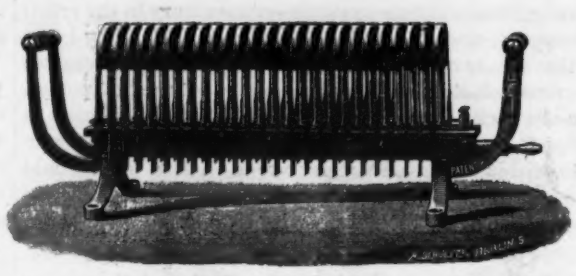


Fig. 1.—The Gulcher Thermo-Electric Battery.

sistance 0.48 ohm. It is evident that the thermo-battery is not adapted for the generation of heavy currents with high electromotive force, but there are a number of applications where it can be used, and especially where no dynamo is available, or the trouble experienced with batteries is to be avoided.

The manufacture of this battery has been taken up by the well-known firm of Julius Pintsch, of Berlin, and one type is especially adapted for depositing nickel and other metals. It is also well adapted for electrolytic laboratory work, and is also to be employed by physicians for the generation of current for small incandescent lights. Besides having these thermo-batteries heated by means of gas, it is proposed shortly to construct others of larger size to be heated directly by means of coke, and designed to furnish a current of from 15 to 20 ampères. Active preparations are already going on for the construction of these batteries, which, it is said, will soon be placed upon the market. These larger batteries, however, are constructed somewhat differently from the one just described above.

The New Canadian Cable.

A special dispatch from Ottawa of Jan. 28 says: "The Dominion will soon have a cable across the Atlantic entirely Canadian. Yesterday, in the House of Commons, Mr. Curran, member of Parliament for Montreal, presented a petition for the incorporation of the company. The petitioners represent a capital of many millions. Therefore, there is no possible danger of the scheme falling through. The cable will be laid from Ireland to a point in Quebec, on the north shore of the gulf of St. Lawrence. It will run through the straits of Belle Isle. A special station will

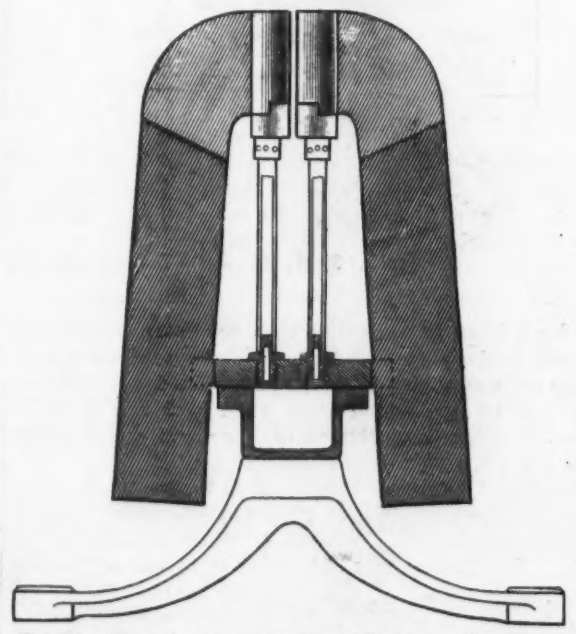


Fig. 2.—The Gulcher Thermo-Electric Battery.

be erected on the Canadian side, and direct communication made with the Canadian Pacific Telegraph Company. Mr. Dobell, one of the incorporators, said last night that he expected the act of incorporation to be passed very soon, and the work of laying would be commenced right away. The company had already made a contract with a London firm for the laying of the cable and supplying of material. This had been accomplished at a cost of $250,000 less than the Mackay-Bennett cable cost. Mr. Dobell thinks that an advantage will be gained by the Canadian cable in its course being so much north of any of the others. There will be no difficulties of crossed cables or unpleasant mistakes when a break has to be attended to. Mr. Dobell has extraordinary faith in his company, and by cut rates hopes to secure a large share of American business. The only difficulty is the laying of the cable in the straits of Belle Isle, but the submarine engineer who reported on the course says that there is a regular bank through the straits under which the cable can be safely laid."

New Edison Central Stations for New York.

The annual meeting of the stockholders of the Edison Electric Illuminating Company of New York was held on Jan. 28. Action was taken to increase the capital stock of the company from $2,500,000 to $4,500,000, for the purpose of extending the business of the company. It was also resolved to issue a mortgage to secure a series of bonds for $2,000,000, running 20 years, and bearing five per cent. interest.

It was also decided to begin without delay the construction of a new 100,000 light station, somewhere in the neighbood of the City Hall, to supply the entire down-town district, and to push at once the construction of the Fifty-third street Station for 50,000 lights. The officers elected for the ensuing year are: Spencer Trask, president; R. R. Bowker, first vice-president; John I. Beggs, second vice-president and general manager; J. B. Skehan, secretary and treasurer.

The New Jersey Electric Lighting Association.

At a meeting of electric lighting companies of New Jersey, Jan. 28, at the residence of Mr. H. W. Pope, the New Jersey Electric Lighting Association was formed and the following officers were elected: Henry W. Pope, president; J. T. Ridgeway, first vice-president; Hon. E. A. Armstrong, second vice-president; Alex. S. Brown, secretary and acting treasurer. Executive Committe: H. W. Pope, Elizabeth; J. T. Ridg-

Fig. 2.—The Moennich Telemeter—Receiver.

way, Trenton; Hon. E. A. Armstrong, Camden; Alex S. Brown, Morristown; D. H. Applegate, Red Bank; Stuart Lindsley, Orange.

Credentials at the Kansas City Convention.

To the Editors of The Electrical World:

From the fact that the undersigned is receiving many letters from gentlemen connected with electric lighting central station companies in all parts of the United States, requesting information as to what credentials will be required to obtain the full privileges of active membership at the Kansas City Convention, Feb. 11-14, I desire to say that there is no constitutional provision or written by-law covering this question.

Any deliberative assembly, composed of individuals representing corporations, undoubtedly has a right to require any delegate to prove that he is authorized to represent the corporation under whose name he votes. For this reason and because of the fact that the coming convention will be attended by a large number of new members, it is very desirable that *every* gentleman who takes an active part in the convention bring with him a letter from the central station company, under whose name he votes, naming him as its representative.

For the reason that the papers and committee reports to be read in Kansas City are not only greater in number than at any previous convention, but are of more than ordinary value, treating, as most of them do, with the practical questions which demand an immediate solution at the hands of the electric lighting fraternity, and also on account of the very elaborate and complete exhibit of apparatus by the associate members, it is desirable that everything be done which will facilitate getting the convention quickly into working shape. Nothing will facilitate the work of the convention more than for each delegate to come properly accredited.

Allan V. Garratt,
Secretary and Treasurer of the National Electric Light Association.

New York City, Feb. 1, 1890.

Lieutenant Fiske's Range and Position Finder.

In gunnery practice, the success obtained depends, evidently, upon the accuracy with which the distance of the object fired at is judged by the gunner. In order to obtain greater accuracy in firing, therefore, independent of the mere judgment of those handling the guns, various means have been proposed in the past and some, indeed, applied to a limited extent. Among these we may mention the plane table method, by which two observers stationed at the ends of a known base line obtain the angles at their respective points between the base line and the object to be fired at. The angles thus obtained are plotted on a plane table and the distance determined by scale measurement. This requires some method of communication between the two observers at the end of the base line, which, in the past, has usually been done by flag or "wig-wag" signals, or, in some cases, by means of a telegraph line connecting the two observers. The method in either case is a tedious one, and hence other means of accomplishing the object have been sought. But for ships the problem of range finding has heretofore been considered almost unsolvable.

A splendid solution of the matter has, however, recently been achieved by Lieut. Bradley A. Fiske of the United States Navy, and as his new range finder marks a decided departure in this important field, and involves a beautiful application of electrical principles, we propose to give our readers a complete description of it.

Before entering into the actual construction of the apparatus it will be well to fix in the mind of the reader certain preliminary principles involved. Thus in Fig. 1, let *a b c d* represent the four members of an ordinary Wheatstone bridge, and *g* the transverse member, in which is connected the galvanometer *g'*. A battery *f* is also connected to the bridge in the usual way. In the members *c* and *d* are placed the fixed resistances *c'* and *d'*, and in the member *b* the variable resistance *b'* also, as usual. One wire from battery *f*, however, connects to the end of member *c*, and also to the pivot *l* of a swinging arm *i*. The extremity *k* of arm *i* moves over and maintains electrical contact with an arc *h* of conducting material, which has one extremity *j* connected, as shown, to the member *a* of the bridge. It is obvious that when the arm *i* is in the position shown in full lines in Fig. 1 then the current will traverse the whole arc *h*, and when the arm is in the position indicated by dotted lines, then the arc *h* will be cut out and the current will pass directly to member *a*. Now, let us assume the arc *h* be made of such material and so proportioned that its electrical resistance to a current traversing it will be proportional to the length of arc included between the contact end *k* of arm *i* and the connecting point *j* of member *a* with the arc. Therefore the resistance interposed in the member *a* of the bridge will be commensurate with the angle *j l k*, and if this resistance be known the angle is also known. Let it now be assumed that the galvanometer *g'* and variable resistance *b'* be located at some point distant from the moving arm *i*, from which the arm is invisible or inaccessible. Clearly, then, an observer stationed at the galvanometer *g'* and resistance *b'* can, by noting the galvanometer and adjusting the resistance in the usual way, determine the resistance equilibrating any position of arm *i* along the arc *h*, and so discover the angle of adjustment of the arc; or, having adjusted the resistance *b'* at some given figure, the observer may, by simply noting the galvanometer, determine when the arm *i* is placed at a desired angle corresponding to the adjusted resistance, and this indicating device may obviously be at the place where the moving arm is located, so that the operator there may thus know when he has placed the arm at the predetermined point or at the distant station; in the same way the operator in charge of the resistance *b'* may know that the arm has been adjusted properly; or two indicating devices in the same circuit may give warning to both operators simultaneously.

Various practical applications of this apparatus will readily suggest themselves. Thus, for example, the elevation or training of a gun may be determined or recognized from a distant point, the longitudinal axis of the gun corresponding to the arm *i*.

Referring now to Fig. 2, it will be apparent that in lieu of the variable resistance *b'* in the member *b* there is arranged an arc *h'* and swinging arm *i'*. The arc *h'* is connected at one end *j'* to the member *b*, and the swinging arm *i'* makes contact at one end *k'* with the arc, and to its pivot *l'* is connected the member *d*. The arrangement and construction of arc *h'* and arm *i'* are similar to that of arc *h* and arm *i*. Consequently when the arm *i* is set at a certain point on the arc *h* the arm *i'* must be set at the corresponding point on the arc *h'*, in order that the resistance of the lengths of the arcs *h h'*, respectively, between the point *k* and point *h* and point *k'* and point *h'* may balance; hence if the arm *k* be set at a certain angle the observer at arm *k* may recognize that angle by noting the position of the arm *k* and the galvanometer, as before. It will be observed, however, that the effect of moving the arm *i* over the arc *h* is practically to lengthen or shorten, or to interpose more or less resistance in, the member *a* of

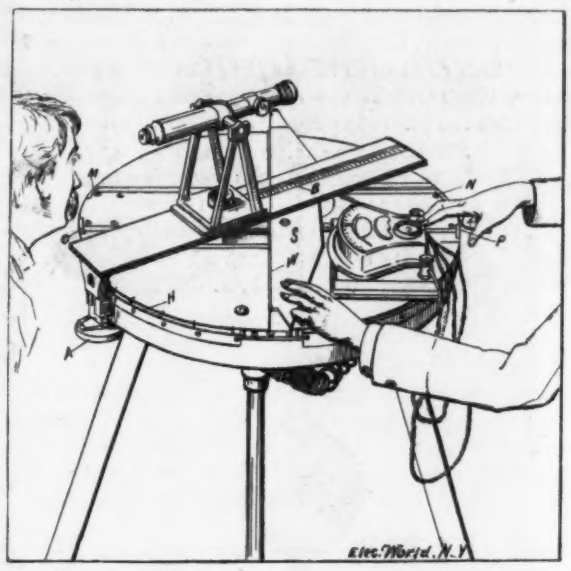
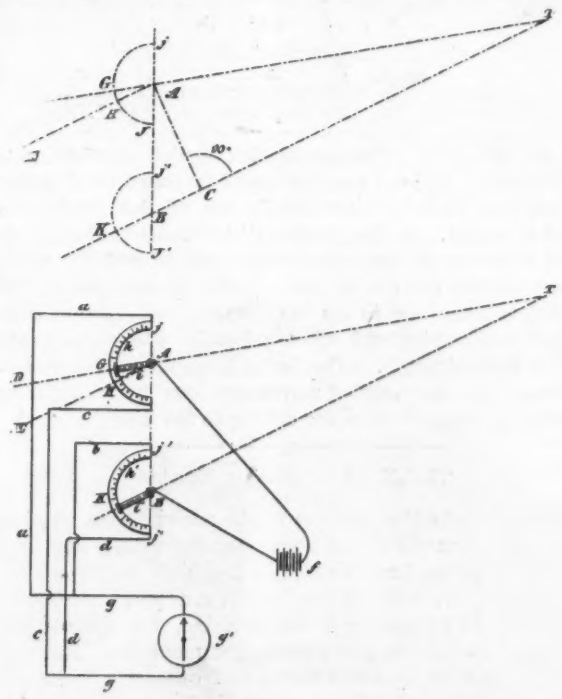


FIG. 7.—FISKE'S ELECTRICAL RANGE FINDER.

the bridge, and by operating the arm *i'* a like effect is produced in the member *b*. The resistances or lengths of the members *c* and *d* remain unchanged.

Referring now to Fig. 3, there is shown the arrangement which forms the specific basis of Lieutenant Fiske's invention. Here the arc *h* is connected at its respective ends *j J* to the members *a c*, and the arc *h'* is similarly connected at *j' J'* to the members *b d*. The battery wires connect to the pivots *l l'* of the arms *i i'*, as before. Now, when the arm *i* is moved from its middle position on its arc toward *j*, less resistance is caused in the member *a* and more resistance in member *c*, and when moved in the opposite direction the reverse occurs. So, also, a similar effect is produced by moving arm *i'*, and thus the resistance offered by all four members of the bridge may be affected instead of that due to only two of them, and differential results may be obtained, as will more fully be apparent in the following description of the device for measuring distances.



Referring to Fig. 4, let *T* be the position of the object, the distance of which from the point *A* it is desired to ascertain. Let *AB* be any short base line. Draw *AC* at right angles to *BT*, *EA* parallel to *BT*, and prolong *AT* as to *D*. By trigonometry

$$\left.\begin{matrix} AC = AT \sin ATC \\ AT = AC \operatorname{cosec} ATC \end{matrix}\right\} \text{and} \left\{\begin{matrix} AC = AB \sin ABC, \text{ whence} \\ AT = AB \sin ABC \operatorname{cosec} ATC. \end{matrix}\right.$$

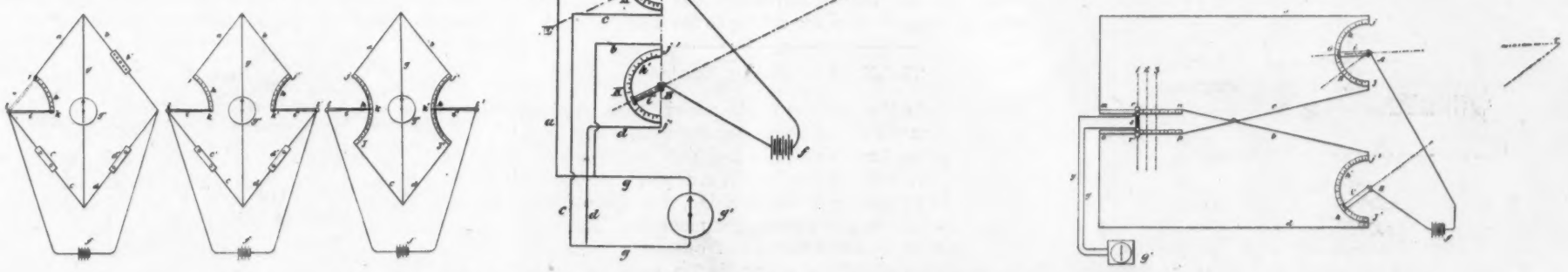
AB, being the measured base line, is known, and the angle *ABC* at the point of observation is easily determined, so that the angle *ATC* remains to be found; but *ATC* = *DAE* and *DAE* is subtended and measured by the arc *GH*. Arc *GH* = arc *jH* — arc *jG*, and arc *jH* = arc *J'K*; hence arc *GH* = arc *j'K* — arc *jG*.

In Fig. 5 the diagrams Figs. 3 and 4 are combined, *i i'*, as before, being swinging arms traversing the arcs *h h'*, and the connections *a b c d* of the bridge being present also, as before. Let the arms *i* and *i'* represent telescopes, both directed upon the object *T*. The arcs *jG* and *j'K* not being equal, the bridge will not balance; but when the telescope *i* is moved to the line *EH* then the bridge will balance, but the distance thus moved is the arc *GH*, the length of which may be read off from the arc *h* itself. It will be seen, therefore, that the operation of determining the distance *AT* becomes, by the aid of this apparatus, exceedingly simple. The observers at the respective telescopes *i* and *i'* direct their lines of sight upon the object. The observer at *i* notes the angle *jAG* or length of arc *jG*. He then moves the telescope *i* until the galvanometer *g'*, which is placed conveniently near his position, shows no deflection and notes the angle *jAH* or length of arc *jH*. The difference between the arcs *jG* and *jH* equals the arc *GH*, whence the angle *ATB*, and hence the distance *AT*, is found by the observer at the arm *i*. or, in other words, by an observer at the base line. The disposition of the apparatus whereby an observer at a point distant from the base line may at once read off the distance *AT* from a suitable scale will now be explained.

Referring to Fig. 6, the members *a* and *b* of the bridge are connected to opposite extremities of a bar *m n* of conducting material, and the members *c d* are connected to the extremities of a similar and parallel bar *o p*. Adjustable upon these bars is a slider *r r'*, having a middle portion *s* of insulating material, so that the current from bar *m n*, for example, does not pass across the slider *r r'* to bar *o p*, but proceeds by the wire *g* through the galvonometer *g''*, which here takes the place of the galvonometer *g'* in the preceding figures.

Suppose, now, that the telescopes *i* and *i'* are sighted upon the distant object *T*, as before, and that the slider *r* is at the middle point 1 of the parallel bars *m n* and *o p*. The resistances in the bridge will obviously not balance, and the galvanometer will be deflected. It has already been explained in connection with Fig. 5 how, by moving telescope *i* to the point *H*, the resistances might be balanced, and if that were done, with the arrangement shown in Fig. 6, the fact would obviously be indicated by the galvanometer standing at zero; but, now, let it be assumed that the telescope *i*, after being sighted upon the object *T* is not moved, or, in other words, that the observers respectively at the two telescopes *i* and *i'* simply adjust their instruments in line with *T*. Obviously, then, the distance of the bridge *r* to *G* (member *a*) is less than the distance from *r* to *k* (member *b*) by the length of the arc *GH*. Similarly the distance on the bridge from *r'* to *G* (member *c*) is greater than the distance from *r'* to *k* (member *d*) by the length of arc *GH*.

Now let the resistance per unit length of the bars *m n o p* be made equal to or with some definite relation to the resistance per unit length of the arcs *h h'*, and lay off on bar *m n* a distance of *r* 3, and on bar *o p* a distance of *r'* 3, these distances being such that the resistance due thereto will be equal to that of the arc *GH*. Clearly, if the end *r* of the slider be moved to the position 2 on bar *m n*, the member *a* will be increased and the member *b* will be diminished by the distance *r* 2, which offers a resistance equal to one-half that of arc *GH*, and if the end *r'* of the slider be moved to the position 2 on bar *o p*, then the member *c* will be decreased and the member *d* increased by the distance *r'* 2, which also has a resistance equal to one-half of arc *GH*. As both ends of the slider move simultaneously, it follows that when its extremities are adjusted to the position 2 then the bridge will balance and the sound in the telephone will cease. Applying this practically, let the bars *m n o p* be laid off in suitable scale divisions from *r* to *n* and *i'* to *p*. The two telescopes *i* and *i'* being sighted on the object, the distant observer observes the galvanometer *g''* and moves the slider *r r'* along the bars *m n o p*, until the needle marks zero. The scale marked on the bars then shows an indication corresponding to the length of arc *GH*, or the actual distances corresponding to such indications. This scale is on the same bar with the telescope, so that the distance indications are corrected automatically for the expression sin *ABC* in the formulas above.



FIGS. 1, 2, 3, 4, 5 AND 6.—FISKE'S ELECTRIC RANGE FINDER.

To illustrate the practical application of the apparatus, the following instance may be given: The telescopes *i i'* mounted upon their arcs *h h'*, are given to two observers, who proceed to a skirmish line, or to any other advanced position, and, selecting a base line of predetermined length, train their instruments upon any desired point of an enemy's works or column. The fact that this is done may be indicated by a flag signal, or by one sent electrically to the rear over the bridge connections. The observe

at the telephone g'' may be supposed to be stationed in proximity to a battery of guns ready to open fire. As soon as the signal is sent that the telescopes are sighted the observer at the galvanometer adjusts the slider $r\,r'$ until the needle stands at zero, and then determines the range from the marks on the bars $m\,n\,o\,p$, when the guns are laid accordingly.

But it is on board ship that the device obtains its greatest value, and a set of Lieut. Fiske's apparatus is now nearing completion at the works of the Western Electric Company in this city and will shortly be placed on board the U. S. S. Baltimore. Our illustration Fig. 7 shows the range finder as it actually appears. The adjustable resistance wire is placed in the groove H, and the bridge wires $M\,N\,O\,P$ are traversed by a slider S which carries a cross wire W. When the galvanometer, which is of the Weston pattern, stands at zero, the distance of the object sighted at can be read off directly on the scale B.

A large number of tests made with the instrument show that its accuracy is within a fraction of one per cent., which is much greater than that of the gun itself.

Electro Deposition of Iron.

The following recipe is given by Messrs. Barthel and Möller, of Hamburg: Six hundred grams of ferrous sulphate ($FeSO_4$) are dissolved in five litres of water; to this is added a solution of 2,400 grams of carbonate of soda (Na_2CO_3) in five litres of water. The resulting precipitate of ferrous carbonate, $FeCO_3$, is then re-dissolved by the addition in small quantities of strong sulphuric acid, until the precipitate is just dissolved, when the fluid will show a green color; it is then diluted to twenty litres by adding water. The solution must be faintly acid, turning blue litmus paper deep claret color, but not red. An iron anode is used.

Kinsman's Electric Ice-Cutting Machine.

In many districts of this country ice-cutting constitutes the principal industry in winter, giving employment to a large force of men and animals. The horse has up to the present been the principal source of power required to operate the ice-cutting machines but it is hoped that it will soon be supplanted by the electric motor for that purpose. A step in this direction has been taken by the construction of an electric ice-cutter, designed by Mr. F. E. Kinsman, of this city, and illustrated in front and side elevations, respectively, in the accompanying engravings, Figs. 1 and 2.

The apparatus consists of an electric motor suitably mounted upon the axle of a pair of spurred wheels, upon the inside of which is placed a ring gear. The shaft of the motor armature is of sufficient length to allow the small pinions upon its ends to engage the ring gear for the purpose of propelling the carriage or carrier. Upon this armature shaft are placed the cutters or saws in gangs as required.

It will thus be seen that there is a fixed relation between the progress of the carriage and the speed of the knives or groovers, the same being true of the cable drums, whose shafts, for obvious reasons, carry a much larger pinion than the armature shaft. These drums pay out a specially constructed cable or conductor in advancing and take it up on the return trip either by backward or reverse movement, or by turning the machine "right about." The

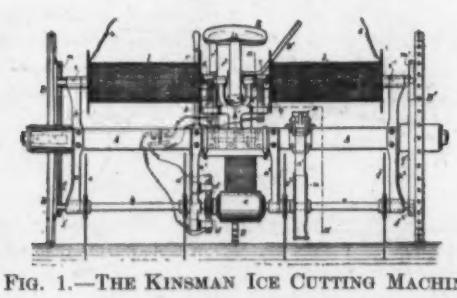


FIG. 1.—THE KINSMAN ICE CUTTING MACHINE.

armature shaft also carries corrugating knives where desired, for the purpose of preventing ice-house freezing, which occurs when two smooth surfaces of ice come together. It will also be seen that considerable speed and any required amount of power can be had with a minimum of weight, matters of great importance upon both thick or thin ice.

The standard size machine weighs less than a good-sized horse, with the advantage of having its weight distributed over a large area as compared with the animal, and proceeds without shock or the pounding motion of the horse. It requires but one operator, and is easily transported from place to place. A two-knife cutter, it is claimed, can do the work of twenty-five horses, each requiring a leader and plow man. It is also important to note the advantages gained by cutting nearly through the ice, since it then splits off much straighter and saves trimming, etc. The depth of cut can be regulated at will by the operator, who, by means of a lever, is able to raise the cutters clear of the ice, the knives then taking a position under the driver's seat without interfering with the progress of the machine. He is also able to start, stop, or reverse the apparatus by simply turning an electric switch. The machine is automatically guided by an arm with a hardened steel ferrule, which runs in the last groove. The current for operating the machine may be obtained from the usual steam lifting plants, or a portable apparatus, such as is used with threshing machines or steam drills, in connection with a dynamo. Flexible leads connecting with the machine allow of free movement; or, if desired, a portable storage battery plant could be used in connection with the machine.

A New Adjustable Lamp Pendant.

In many situations it is desirable to have incandescent lamps so mounted that they may be adjusted to any height and in the course of his practice, Dr. W. F. Bradner, formerly of Greeley, Col., found it necessary to employ such a device. This resulted in the construction of the adjustable pendant illustrated in the accompanying engraving and which is manufactured by Messrs. Sanborn, Phillips & Co., of Greeley, Col. The suspension device consists of a differential pulley arrangement having two rollers of unequal diameters upon which the flexible conducting cord is wound. As the position of the lamp is altered, the cord is unwound from one roller and wound up on the other, so that there is no slack cord to be disposed of. The pulley is contained in an ornamental case, about three inches in diameter, and when properly adjusted operates at the lightest touch. The lamp remains in any desired position, and its range of movement can be made to include any distance from the ceiling to the floor.

ADJUSTABLE PENDANT FOR INCANDESCENT LAMPS.

The Kind of Motor Wanted.

It seems to be the tendency at the present time, says the *Iron Age*, to provide each machine with an individual or independent power for driving. The methods may be divided into steam, air, and electricity. When power is wanted solely for the propulsion of one machine, it is quite under the control of the operator using that machine. This does away with expense, constructive and operative, connected with shafting, and reduces materially the wear and tear. The machine is used only when needed, and all expense ceases when the machine stops. Compressed air has been considerably used in Paris. The advantages derived from its use are not equal to the disadvantages from the necessary piping peculiar to the machine itself and the deficiency in the power obtained. The electric motor, as a self-regulating machine, is beyond all doubt superior to any other machine in the market for the generation of power. It will transmit 92 to 93 per cent. of the work in the current delivered to it. Again, it requires no attendance except occasional oiling; wear and tear is reduced to journal wearing, and it requires no piping to carry away hurtful gases. In point of regulation it is as effective as the best steam-engine governor. As now built it is guaranteed to run within two per cent. of the speed regulation provided by the contract. The good points of the electric motor are not appreciated as they should be, and it would be more extensively used if its driving shaft were reduced in speed. The mechanic looks with suspicion upon a speed of 1,500 revolutions a minute. Another feature which acts against the introduction of the electric motor is the first cost. Considering the horse power derived from it and the cost of construction, this is unnecessarily high. What we want is a low-speed, moderate cost, electric motor.

Densuming a Heinous Crime.

A circular on pink paper is being distributed among electricians that causes them no little wonder and amusement. We give it below:

"For 16 years I have been horribly tortured by the most ferocious and despicable of bandits. As he has full control of my brain and therefore is the master of my will, I cannot even commit suicide. In order to conceal the crime he moderates the torment before people and makes me appear quiet and content; but as soon as I am isolated I suffer a dreadful martyrdom. No distance whatever can put me out of the action of the fluid which annihilates me and I believe to be of an electric nature. If nobody attempts to deliver me, the phenomenal bandit will prolong my agony according to his wishes. I came from Columbia in order to densume the heinous crime, but not knowing the language of this country I have heretofore been unable to do anything. Now, by means of this sheet I call the attention of the government and that of honest men, making them hear the cry for the most needed help which has ever been uttered.

"Thinking of my misfortune, everybody shall feel inclined to protect me and find it an easy matter by wresting from the electricians their secret for the neutralization of the cause used to communicate me the fluid.

"I hope that everybody is not corrupted in this world.

"TOMAS ORIBE."

The McLaughlin Storage Battery.

During the past month several long trips over the Philadelphia People's Line have been made by a car equipped with 92 cells of the McLaughlin storage battery, 46 cells on each side of the car, and two 15 h. p. Sprague motors. With but one exception every trip of this car was satisfactory in every respect. The 92 cells were not all used at the same time while the car was in action; only half the number being operated for two hours at a time. By the aid of a switch the load was thrown on the other 46 cells, and so continued alternately every two hours. This enabled the cells to rest, and is intended as a means to enable them to recover their voltage. When additional power was required only for a few minutes to propel the car over a very steep grade, the entire 92 cells were worked in series.

The McLaughlin battery cell is six inches square at the base and seven inches high, and is composed of silica and sulphur. The plates consist of an alloy of tin and lead. The plate will, it is said, withstand a heavy rate of charge and discharge, and when formation is complete the metallic part of the plate becomes a part of, and just as porous as, the active material itself. It is also claimed that there is no possibility of "buckling." One cell of this battery was tested recently, and stood a discharge of 100 ampères without any apparent ill effects.

The Actino-Electric Effect of the Ultra-Violet Rays.

Among the many investigators into this subject is M. Righi, who attributes the effects to the convection of negative electricity, the charge being separated from the illuminated surface under the influence of the ultra-violet rays, and carried in the direction of the lines of force. M. Righi has shown the existence of this convection by means of aluminium vanes, which were made to move in presence of the rays. The rate of convection, which depends on the capacity of the conductor per unit surface, varied in M. Righi's experiments from 50 to 150 metres per second. M. Righi also succeeded in deviating the convection streams by means of an air blast.

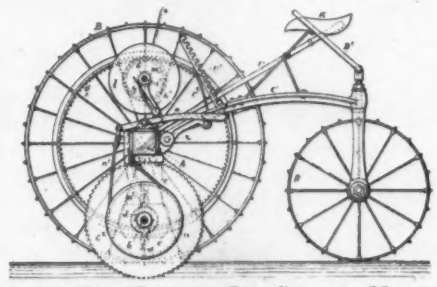


FIG. 2.—THE KINSMAN ICE CUTTING MACHINE.

An Electric Gas Governor.

The following is a description of an electrical device for regulating the pressure of the gas in house mains, which was to be seen at work in several parts of the Paris Exhibition. The apparatus consists of an indicating dial and a pair of electro-magnets, the armatures of which actuate a ratchet wheel in opposite directions, closing or opening the gas admission valve as may be necessary. The index of the dial is in connection with one pole of a battery, the other pole being connected through the two electro-magnets to two contacts on the dial. These contacts can be arranged so that a variation in either direction from the standard pressure will bring the lower end of the index against one or the other of the contacts, and the circuit being closed, one of the electro-magnets comes into play, and actuates the admission valve. This form of governor is said to act rapidly and effectually,

Electric Tramway at the Salmon Falls Mills, N. H.

A need of better facilities for the transportation of supplies and manufactures in many large mills and factories has led to the adoption of electricity as a motive power. This has usually been easy to accomplish, owing to the fact that nearly all the important mills are provided with lighting plants, so that from the same dynamo that supplies the lamps sufficient current can be taken for the operation of an electric tramway.

The accompanying view is made from a photograph of the tramway recently installed by the Thomson-Houston

SALMON FALLS MILLS ELECTRIC ROAD.

Motor Company at Salmon Falls, N. H, The total length of the track is about 2,000 feet, extending the entire length of the mill yard; it is of standard gauge (4 feet 8½ inches) and laid with T rails. The same method of overhead construction as is employed on street railways is used here, the trolley wire being suspended from cross wires and brackets. In order to make the return circuit more perfect than would be the case if the rails only were used as conductors, a supplementary wire is run between them and connected by tie wires, one end being riveted to the rail and the other soldered to the supplementary wire.

The generator used for supplying the current is a shunt-series machine, wound for 500 volts, and capable of delivering 15 h. p. It is placed in the basement of the mill, and driven by water power. The motor car is 14 feet long and 6 inches wide. The truck, which has a wheel base of 4 feet 6 inches, is equipped with two 3 h. p. railway motors capable of taking a load of 6,300 pounds up a grade of 5 per cent. without the least difficulty.

The advantages to be obtained and the saving in handling supplies and finished goods effected by the use of electric tramways cannot fail in a short time to bring them into general use. They are also applicable to interiors where a truck can be used to collect material, transport it to the elevators and to the various parts of the mill. The Thomson-Houston Motor Company has already made several installations of this sort and has many new ones under contract.

The McIntosh Chloride of Silver Battery.

Ever since the experiments of Galvani and Volta resulted in the production of the galvanic battery, there has been a constant effort on the part of electricians and inventors to produce a battery that would be compact, portable, constant in action, cheap in construction, and require but little attention. This field was worked by the electricians of a generation ago, and since then so carefully and thoroughly has the ground been gone over that but few combinations have remained untried. Many of the batteries that are to-day widely and successfully used are modifications of batteries, the originals of which have been long in existence.

That form of portable battery, which has longest claimed the attention of physicians, and which has been used by them constantly for years, is the ordinary carbon and zinc battery with the solution of bichromate of potash and sulphuric acid as the exciting fluid. The strength of the current furnished begins, however, to diminish the instant the battery is used, and becomes gradually less until the exciting fluid is exhausted or the zinc consumed.

Another form of battery is that in which chloride of silver plays a prominent part, and which in many respects is the ideal portable battery for physicians' use, the serious objection being the first cost, though that is overcome to a certain extent by the recovery of the chemically pure silver. Again, as a chloride of silver battery requires no corrosive fluids, there need be no local action, and the elements need not be removed from the electrolyte. And as the cells, while numerous in proportion, do not require as frequent replenishing, the expense in the long run is about the same.

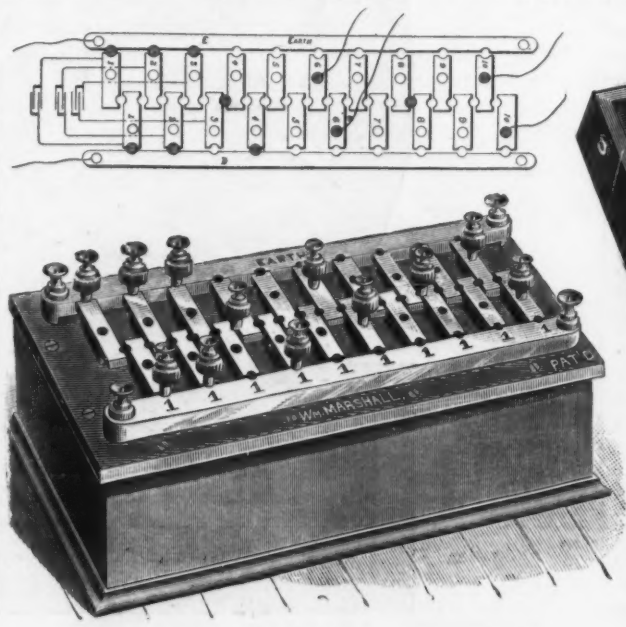
In a chloride of silver battery now being introduced by the McIntosh Battery and Optical Company, of Chicago, several new features appear that combine to make it a battery of special value to the medical fraternity. For instance, the glass tube that insulates the silver wire rod extending from the plate passes through the cork and beneath the fluid, so that no electrolytic action can take place on the under surface of the cork. There is also added a vent tube, which is a distinctive feature of the battery, and permits of the free passage of air or gases, thus preventing the possibility of an accident by reason of an accumulation of gases within the cell.

Using the cell as a generator, the McIntosh Company have combined with it a switch-board with double switch, that permits the use of any one cell from any portion of the battery, either by itself or with contiguous cells. A milliampère meter is also added, and for those who may desire it a faradic coil is supplied, of the pattern illustrated. The company make a 32-cell and a 50-cell galvanic, and a 32-cell and 47-cell combined galvanic and faradic apparatus.

Marshall's Improved Multiple Series Condenser.

We have from time to time described improvements in condensers which have been introduced by Mr. William Marshall, of this city, and especially on the type of multiple-series condensers, of which he is the originator. In these condensers, it will be remembered, the various sections can be connected up either in series or multiple arc, or in a combination of both, so that a very large range of capacities can be obtained with but a small number of sections.

In the form of condensers first designed by Mr. Marshall for this purpose, the connections required between one section and another necessitated the screwing down of a connection consisting of a short length of wire. While not involving a great inconvenience, this method still required some time for manipulation, and it was to avoid even this small inconvenience that Mr. Marshall has now designed the condenser which is illustrated in perspective in the accompanying engraving Fig. 1, and the detail arrangement of which is shown in Fig. 2.



FIGS. 1 AND 2.—MARSHALL CONDENSER.

Mc INTOSH CHLORIDE OF SILVER BATTERY.

The improvement introduced in this condenser over the older form consists in substituting for the wire connectors plugs, by means of which any section can be connected with its neighbor by means of a plug. The brass connecting blocks, it will be noted, are extended beyond the centre of the box for that purpose and provided with plug holes. Each section represents 0.1 microfarad capacity; and, as connected in Fig. 2, the plugs on the left half of the condenser have sections 1 and 2 placed in parallel, and sections 3 and 4 in series, making their combined capacity 0.25 microfarad. These sections can be used for any purpose, while at the same time others of the box may be used for other purposes; thus, as is shown, sections 6 and 10 are independently connected and may be used as standard capacities for other measurements.

Assuming the capacity of each section to be 0.1 microfarad, the condenser would have a range from 1 microfarad to 0.01 microfarad, besides being capable of providing, if necessary, 10 separate condensers of 0.1 microfarad each.

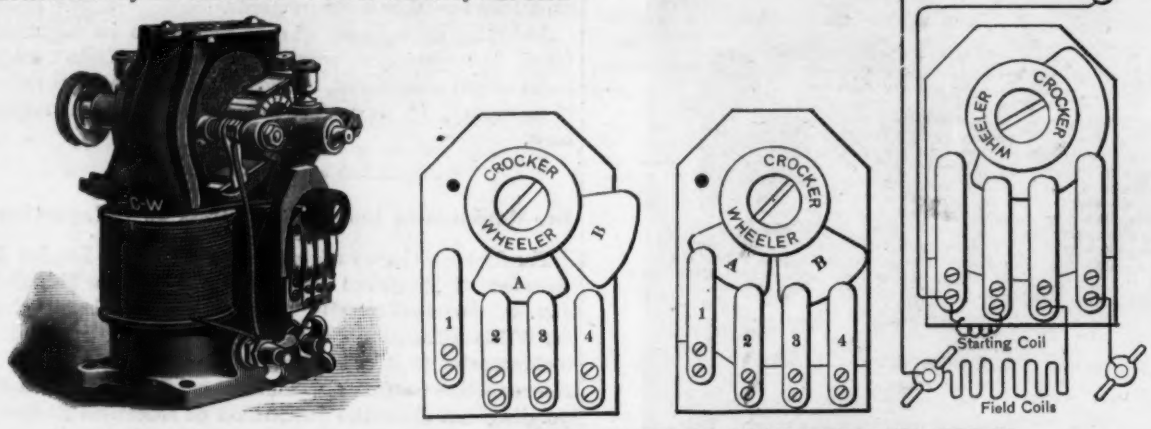
Dr. Hopkinson's Inaugural Address on "Magnetism."

The first meeting of the new session of the London Institution of Electrical Engineers was held on Thursday Jan. 9. Before formally vacating the presidential chair Sir William Thomson delivered a short address in which he took occasion to refer in suitable terms to the accession to the council of Sir James Anderson and Sir Henry Mance; pointing out how the Institution of Electrical Engineers was originally founded by telegraphists. A vote of thanks to Sir William for his services during the past year having been agreed to by acclamation, Dr. John Hopkinson, the president-elect, was installed in the presidential chair, and proceeded to deliver a most interesting address on "Magnetism."

The upshot of the recent study of magnetism by practical men, although it has resulted in a great addition to our knowledge of facts, has left us, said Dr. Hopkinson, as far off as ever from any explanation of these facts. The chief facts to be explained by any theory of magnetism are, first, why iron, nickel and cobalt are enormously magnetic and other substances practically non magnetic; second, the phenomenon of magnetic saturation; third, the phenomenon of residual magnetism; fourth, the phenomenon of "hysteresis." As an example of the energy lost in hysteresis, Dr. Hopkinson quoted the following figures: In a sample of Whitworth's mild steel the loss per complete cycle is about 10,000 ergs per cubic centimetre. In oil-hardened hard steel the loss is nearly 100,000, while in tungsten steel it is 200,000. If the armature of a dynamo be made of good iron, the loss from "hysteresis" may easily be less than 1 per cent.; if, however, it should enter the head of any would-be epoch-making inventor to make his armature of tungsten steel, he would have the satisfaction of losing over 20 per cent. in this way.

Dr. Hopkinson then dwelt upon the interesting subject of the magnetic properties of iron alloys, and he brought out very clearly that the magnetic properties of iron are exceedingly easily destroyed. If iron be alloyed with 12 per cent. of manganese, its permeability is only 25 per cent. greater than that of air. Further, there are no signs either of saturation or of hysteresis. In short, all the properties of this alloy would be fully accounted for if we supposed that it consisted of a perfectly non-magnetic material with a small percentage of metallic iron mechanically mixed therewith. Thus the property of non-magnetizability of manganese steel is an excellent proof of the fact that this property appertains to the molecule, and not to the atom. The properties of an alloy of manganese and iron are curious, but more curious are those of an alloy of nickel and iron. The alloy of nickel and iron containing 25 per cent. of nickel is non-magnetic when it comes from the manufacturer; that is to say, a substance compounded

of two strongly magnetic bodies is *non-magnetic*. Cool it, however, a little below freezing and its properties change; it becomes very decidedly magnetic. If now the cooled material be allowed to return to the ordinary temperature it is magnetic. If it be heated it is still magnetic, and remains magnetic till a temperature of 580 degrees Centigrade is attained, when it very rapidly becomes non-magnetic, exactly as many other bodies do when they pass through the critical temperature. Now cool the alloy; it is non-magnetic, and remains non-magnetic until the temperature falls below freezing. This alloy may, therefore, exist in either of two states, both quite stable—a magnetic and a non-magnetic—and the particular state is determined by the fact as to whether the alloy has been



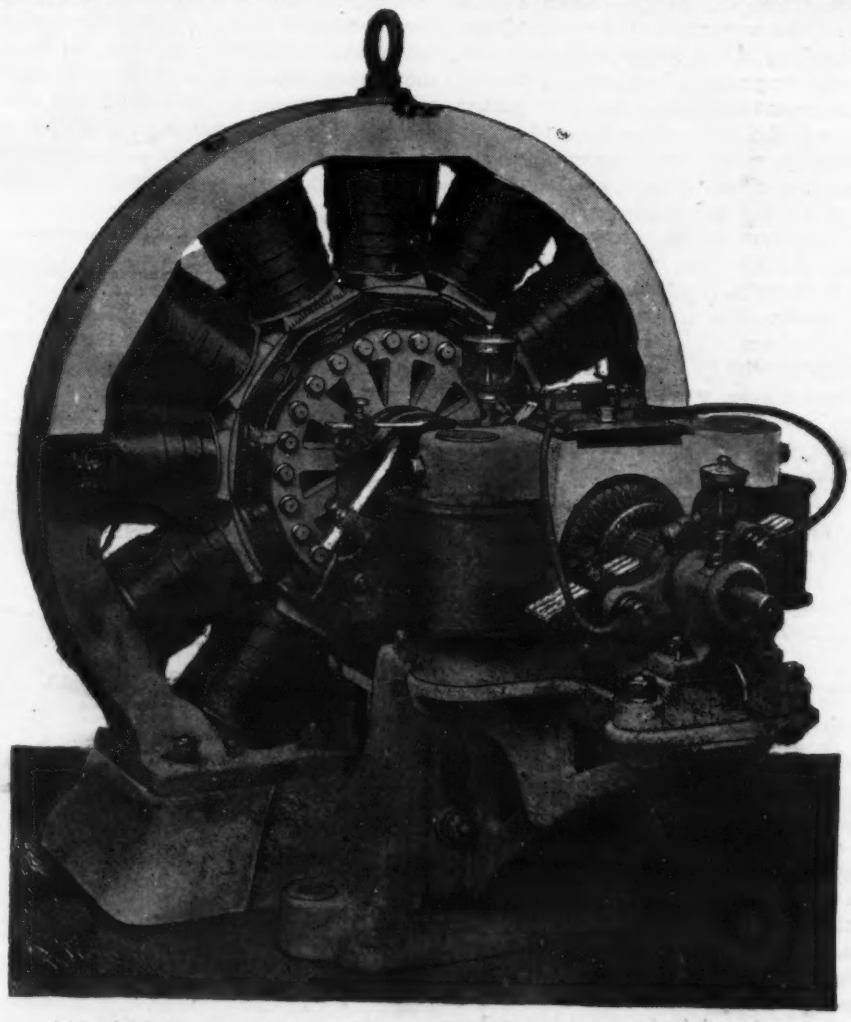
FIGS. 1, 2, 3 AND 4.—NEW CROCKER-WHEELER INCANDESCENT MOTOR.

cooled to — 20 degrees Centigrade or heated to 580 degrees Centigrade.

The next aspect of the question dealt with by Dr. Hopkinson was the relation between temperature and magnetism. He pointed out that the value of μ at 770 degrees Centigrade for small forces is no less than 11,000. If, however, the temperature is raised another 15 degrees Centigrade, the value of μ becomes comparatively infinitesimal, being only 1.14. If, however, the magnetizing current is great instead of small, then as the temperature rises, the value of μ diminishes very slightly till a high temperature is attained, when the rate of decrease is accelerated until, at the critical temperature, the rate of diminution becomes very rapid indeed, until finally the magnetism of the iron disappears at the same time as for small forces. Instead of following the magnetism for constant forces with varying temperature, we may trace the curve of magnetization for varying forces with any temperature we please, and we shall see that the effect of rise of temperature is to diminish the maximum magnetization of which the body is capable, slowly at first and rapidly at the end. It also very greatly diminishes the coercive force and increases the facility with which the body is magnetized. This phenomenon, as Dr. Hopkinson pointed out, is of great importance in relation to the heating of dynamo armatures.

Among the many changes which occur in the properties of iron at the critical temperature at which its magnetism disappears, Dr. Hopkinson dwelt on the fact that its electrical resistance increases with the temperature at an accelerating velocity until, when near the critical temperature, the rate of increase is five times as much as that of copper. At the critical temperature the rate suddenly changes and assumes a value which, as far as experiments have gone, cannot be said to differ from a pure metal. The electrical resistance of nickel varies with the temperature in an exactly similar manner. The last of the many magnetic phenomena lightly touched on by Dr. Hopkinson was the significant one of "recalescence," first observed by Professor Barrett, of Dublin. This phenomenon, Dr. Hopkinson pointed out, was observed with great difficulty in the case of soft iron, was not observed at all in the case of manganese steel, and was observed best with hard steel. The phenomenon of "recalescence" was, Dr. Hopkinson said, simply the following: If a wire of hard steel be heated to a very bright redness and is then allowed to cool, it will cool down until it hardly emits any light at all; then suddenly it glows out quite bright again, and afterward finally cools down. The temperature of "recalescence" has been abundantly identified with the critical temperature of magnetism. Dr. Hopkinson very clearly brought out the importance of the phenomenon by the following figures: As the iron passes the critical point it is found to absorb about 200 times as much heat as is required to raise the temperature of the iron 1 degree Centigrade. Now when ice is melted and becomes water, the heat absorbed is only 80 times the heat required to raise the temperature of the water 1 degree Centigrade, and 160 times the heat required to raise the temperature of the ice the same amount. The most probable explanation of this phenomenon, in Dr. Hopkinson's opinion, is that when iron passes from the magnetic to the non-magnetic state it experiences a change of state comparable in importance to the change from the solid to the liquid state, and a large quantity of heat is absorbed in the change.

What explanations, said Dr. Hopkinson in conclusion, have been offered of the phenomena of magnetism? Poisson's hypothesis, that each molecule of a magnet contained two magnetic fluids which were separated from each other under the influence of magnetic forces, gives no hint of saturation, or of hysteresis, or of the thermomagnetic properties of iron. Weber's theory that each molecule of iron is a magnet with axes arranged at random in the body, and that under the influence of a magnetizing force the axes of these magnets are arranged in a direction of parallelism in a greater degree as the force is greater, thoroughly explains the limiting value of magnetization, gives an account of hysteresis, and helps us to understand the several thermomagnetic phenomena. Ampère's theory that each molecule is a closed electric current in a circuit of no resistance explains several electromagnetic phenomena. One difficulty of this last theory is that when iron ceases to be magnetizable we must assume that the molecular currents cease. These currents represent energy. We should, therefore, expect, when iron ceased to be magnetic by rise of temperature, heat would be liberated; the reverse is the fact. So far as he knew, said Dr. Hopkinson, nothing that has ever been proposed even attempts to explain the fundamental anomaly. Why do iron, nickel and cobalt possess a property which we have found nowhere else in nature? It may be that at lower temperatures other metals would be magnetic, but of this we have at present no indication. It may be that, as has been found to be the case with the permanent gases, we only require a greater degree of cold to extend the rule to cover the exceptions. For the present the magnetic properties of iron, nickel and cobalt stand as exceptional as a breach of that continuity which we are in the habit of regarding as a well-proved law of nature.



MATHER & PLATT ALTERNATING CURRENT MACHINE.

New Crocker-Wheeler Small Motors.

The employment of small motors is increasing from day to day, and every month sees them applied to a new purpose. For continuous operation such small machines ought to be made with the same care that is bestowed upon those of larger size, and in carrying out this idea, the Crocker-Wheeler Company have designed a new set of small motors for constant potential or incandescent circuits, which embody a number of novel and important improvements. Among these we may mention the fact that the construction has been improved to permit the use of wire on the armature two sizes larger than has been possible before, thereby making the winding much less liable to breakage and enabling it to carry more current without heating. The 1-6 h. p. motor is made to run at a practically steady speed, even with the most sudden and heavy changes of load.

Our engraving Fig. 1 shows the 1-6 h. p. motor in perspective, and Fig. 4 a diagram of the starting switch and its connections, by means of which the motor is started without a dangerous rush of current.

In the operation of fans, pumps and other machinery which may be desired to be run at varying speeds, according to circumstances, the practice heretofore has been to throw in a resistance in the main circuit, consisting usually of a lamp mounted on the top of the motor. By means of a new winding and the switches shown in Figs. 2 and 3, the use of the lamp or any dead resistance is avoided, and the speed can be varied between 1,900 revolutions, the full speed, and half speed, 950 revolutions, without any loss of efficiency in the machine.

These motors being built to operate on circuits of a given potential, of course revolve at a definite speed, automatically. As showing the accuracy and uniformity in the construction adopted, the speed of the motor can be employed as an indicator of the pressure on the circuit. Thus, if the speed of the motor is much greater or much less than is marked on the name-plate it shows the circuit is not suited for it. This may then be determined quite accurately by counting carefully the speed of the motor when oiled and running with the belt or load thrown off. It then runs 200 revolutions faster than the speed given on the name-plate, and any difference from that speed shows that the circuit has correspondingly higher or lower E. M. F. Thus a motor marked 110 *volts*, 1,900 *revolutions*, should run free at 2,100 revolutions. If it runs free at 2,000 it shows that the circuit has only about 105 volts, and should be altered accordingly. Among the mechanical improvements introduced into these latest types, is the convenience with which the direction of rotation can be reversed. This can be done by simply changing the brush holders, putting the upper one below. The base is made extra heavy, with the centre of gravity low, to add to the steadiness and solidity of the machine. The bearings are made of the best Babbitt metal, the same as in large steam engines and other first-class machinery, this being a new feature in small motors.

These new machines are built by the Crocker-Wheeler Electric Motor Company, of this city, and are wound for all potentials, both incandescent circuits between 50 and 110 volts and for battery circuits between 4 and 10 volts.

The Mather & Platt Alternator.

The accompanying illustration represents a new alternater, embodying several features of interest, which is now being manufactured by Messrs. Mather & Platt, of Manchester, Eng. As is the case with most alternate-current machines in which the armature contains iron

cores, the armature revolves and the magnets are fixed. The magnets are wrought iron and arranged round the armature, exterior to it, and are attached to a massive cast-iron ring, which forms the yoke connecting the limbs. The attachment is so arranged that any of the magnet cores can be removed without disturbing the remainder or taking out the armature. The armature is constructed of two plates or discs keyed on to the shaft, between which the armature cores are held by bolts. As with the magnets, any section of the armature can be removed without disturbing the remainder. Apertures in the discs allow free ventilation in the interior of the armature cores. The magnets are excited by a "Manchester" dynamo, which is carried on a bracket bolted to the bed-plate of the alternater, the armature shafts being coupled direct.

The machines are manufactured under the patents of Drs. John and Edward Hopkinson. For working with transformers they are constructed either for 1,000 or 2,000 volts, and from 8,000 to 12,000 alternations per minute, or with a "periodicity" of from 66 to 100. The machines can be run in parallel and may be thrown into parallel working without the least danger, even when there is considerable difference between the electromotive forces at the terminals, or the machines are running at different speeds.

The machine illustrated is for an output of 1,000 volts and 30 ampères at 800 revolutions per minute. The armature resistance is 0.55 ohm, and the resistance of the magnets 2 ohms. When working with full load, the current through the magnet coils is 21 ampères, showing an electrical efficiency of over 95 per cent. According to the *London Electrician*, Messrs. Mather & Platt have already constructed several of these machines for central station work, and have a number now in course of construction.

A Glance at Kansas City.

Few portions of the West are richer than the territory surrounding Kansas City in positive indications of the existence of pre-historic races, especially during the period known as the Stone Age, when human beings lived and died along the banks of the Muddy. From then till A. D. 1500 there is little trace of the occupation of the country by any distinct race of people, but if Coronada and others among the early explorers visited the country surrounding the mouth of the Kansas River during the sixteenth century they probably found, as did Father Marquette, in 1673, that it was fairly well inhabited by tribes of Indians who had found in the bottom lands and sunny slopes along the river a camping ground suited to their wants in every respect. Later on the famous Daniel Boone repeatedly visited this section, as did Lewis and Clarke, when making that memorable trip to the headwaters of the Missouri; and others, and all these travelers made reference to the present location of the town as an excellent one in every respect for the establishment of a trading post. But no habitations of white men were centered here till the year 1821, when a fur trading post was established by Francois Chouteau and his Canadian-French followers. From that time on the growth of the settlement was steady and materially enriched by trading privileges opened with Mexico about the year 1824, the objective point of entry being the town of Sante Fé, now in New Mexico. During that year twenty-six teams and one hundred men were employed in the hard and dangerous task of freighting goods from Kansas City, and so greatly did this single industry prosper that in 1860 there were 7,100 men, 28,000 yoke of oxen, over 6,000 mules and more than 3,000 wagons engaged in hauling freight from Kansas City to western points. In 1834 the first brick house was built, and it is said to be standing out on Twentieth street to-day. The first ferry—a flat boat—was floated in 1834. The first regular hotel was opened in 1846. The first newspaper was printed in 1851, and the first bank established in 1857, by the firm of Northup & Chick. The first railroad to reach Kansas City was the Missouri Pacific, in 1865, the necessary tracklaying for which had been started at St. Louis in 1850, fifteen years previous, the terminal point for many years being Jefferson City. In December, 1864, the Kansas Pacific had completed a line from Kansas City west to Lawrence, Kan., and the first locomotive seen in Kansas City was brought by steamer from St. Joseph for use on that line, which was completed through to Denver in 1871. In 1867 Fort Scott was connected by rail, also the towns of Hannibal and St. Joe.

The rush of emigrants to California in 1849-50 helped to build up the town, and many merchants in the outfitting business materially prospered.

The first set-back came with the introduction of Asiatic cholera in 1849. Then occurred the Kansas or Border war in 1854, which temporarily affected the city's growth, but which proved only a bitter foretaste of the almost total destruction of its prosperity that followed the declaration of war in 1861, for the rising town at once became the common prey of every band of "irregulars," and so severely did she suffer that over one-half the population had deserted her precincts before the summer opened. Every industry was neglected; buildings fell in ruins and the streets became almost impassable, and so it continued until after Price's defeat in September, 1864, when the prospects brightened, and during the following two years many new houses were built and the population had increased to 15,000, and doubled that number in the two years following.

Visitors to the city may stand on the bluff and gaze far to the west and to the north, and say, "Nature made Kansas City what she is to-day; her geographical position forced her to come to the front; she is the natural gateway to the boundless Southwest."

When the war was closing Kansas City was stranded; while her rivals, Leavenworth and Atchison, were prospering, and had waxed fat during the conflict. Then was shown that grand spirit of indomitable will and progressive enterprise that has left its mark on every hand. Men who had stood by Kansas City all through her troubles rallied to the front, among the leaders in the earliest movement being the late Colonel Kersey Coates, a gentleman of finished education and marked ability, having clear, broad minded, liberal views regarding the growth and prosperity of the town, and one whose name has been linked with every progressive movement from 1855 till his death, which occurred in 1887.

Following the close of the war Colonel Coates visited the East and by his vigorous presentation of facts relating to the advantages offered he interested the capitalists of Boston and New York in investing millions of dollars in Kansas City property, and every dollar of his own was likewise invested. A promoter of the water works system, of the street railways, and the prime mover in the introduction of the Edison system of central station electric lighting, the keen foresight and the perfect faith of Colonel Coates in the grand future awaiting the development of an industry then in its infancy, is clearly shown in the fact that when his hotel was rebuilt in 1886 he *refused to have a gas pipe placed within the building*, but had it wired throughout for incandescent lights.

Think of the courage and the faith shown in such an example, and at a time when our methods of wiring were not as far advanced; when there were no interior conduits, and when the quality of the insulation on copper conductors had not reached that degree of perfection since attained through the lessons taught by experience.

What has been accomplished in Kansas City during the past five years has been talked about at our breakfast tables, for the city has had a phenomenal growth that afforded ample ground for comment by the journalist.

To-day Kansas City ranks as eighteenth in population, fifth in volume of telegraph business handled, and first in number of telephones in proportion to population and in the number of calls per telephone. During the first seven months of 1889 there were completed 5,200 dwellings, 1,100 stores, and over 2,000 offices within her limits. Her street railways are carrying over 125,000 passengers daily, and there is a total investment of $20,000,000 in that industry alone. In 1865 her population was 3,500; to-day it probably exceeds 225,000.

Such is a brief outline of the growth of the city wherein the electrical fraternity willshortly gather in annual session. The headquarters of the Association have been established at the Coates House, corner of Broadway and Tenth street. The exhibits will be displayed in the Casino, a commodious lecture hall on the ground floor, and but four doors distant from the hotel, while the Association will meet in session at the Coates Opera House, nearly opposite the hotel. Everything is being done to make this gathering the most perfect and pleasing in the history of the Association, and the visitors will be surprised by the receipt of many pleasant little attentions that will materially add to their comfort and make the visit a memorable one.

For this reason, as well as on account of the associations connected with its past history, was the Coates house selected, for there the delegate will secure the same considerate attention and enjoy the trained service and dainty dishes that await his coming at home.

The city is topographically divided into three sections, known locally as "the hill," the east bottoms and west bottoms, Kansas City, Kansas, being a continuation of the latter with an imaginary State line. Down in the west bottoms, at the corner of Eighth and Santa Fé streets, is the station of the Kansas City Electric Light Company, originally incorporated in 1881 as the Kawsmouth Electric Light Company. The total capacity of the station is about 1,000 arcs and 2,300 incandescent lamps of the Thomson-Houston system, the dynamos being driven by Armington & Sims, Corliss and Ide engines.

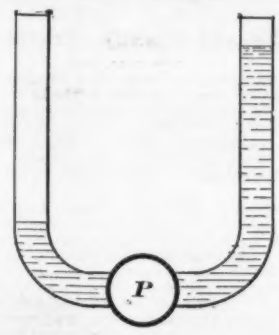
On the hill, at the corner of Fifth and Wall streets, is the station of the Edison Electric Light and Power Company, operating about 6,000 Edison incandescent lamps, scattered over a large area; while over in the eastern section of the city is the station of the American Electric Light Company, operating some 200 arc lights of the American and Ball systems.

In the line of supply houses Kansas City is well fixed, having the Gate City Electric Company, at 522 Delaware street, with a sufficient stock of electrical supplies to supply the stations in the Missouri Valley and the territory tributary thereto. Among the companies that make a specialty of the complete installation of hydraulic, steam, or electric light, power or railway plants is the firm of English, Morse & Co., at 122 & 123 Union avenue; the Pond Engineering Company, who have an office in the water works building, corner of 6th and Walnut; and Horace A. Keefer, Gibraltar Building. Among the prominent attractions in Kansas City during the week the Association meets there will be the Jefferson-Florence Company and the Sarasate-D'Albert grand concerts. F. DEL.

A Review of Modern Electrical Theories.—Discussion.

We give below an abstract of the discussion which took place on the above paper read before the American Institute of Electrical Engineers by Professor William A. Anthony, Mr. George M. Phelps in the chair:

Dr. O. A. MOSES: There are some remarks in Professor Anthony's very interesting observations to which I would like to call particular attention, more especially the last, as bearing upon our practical application of the speculations. He spoke of the possibility of using the molecular action of gases as a means of transforming wave-lengths. If my memory serves, that has been done ever since the Ruhmkorff coil has been in operation, and



the Geissler tube has become so perfect an analyzer of the electric current in that respect we have already anticipated some of these results. Let us consider what we already have. In the Geissler tube you have the attenuated gases; you have two disconnected poles; you have a current passing, and the wave-lengths broken up and the light produced. So that we have right there before us the facts. Whether we can ever utilize the Geissler tube so as to be able to effect these immense economies that the Professor so pleasantly prophesied is a question to be determined. It has been experimented upon, and I have found in my short experience in life that these things come when they are needed.

A MEMBER: There is one question I would like to ask in regard to the wheel hypothesis; that is, when you wish to increase the current of a conductor without increasing the heat waste, it is necessary to increase the area of the conductor. I should think that would increase the number of wheels inclosed in a conductor, and therefore increase the friction by increasing the amount of slip, and therefore increase the heat developed instead of decreasing it.

Prof. ANTHONY: As I understood it, the more wheels there are in a conductor the less is the amount of energy spent in causing the slip over them, because you have got more surface for slips in it. What we call a given current is accompanied by certain magnetic effects. That would mean that the wheels in space inclosed by the conductor are revolving at a certain rate. Now, supposing those all to be revolving at that same rate, and increasing the size of the conductors, and increasing the number of wheels there are in it, the wheels that are in the conductors will be set revolving at a less rate instead of a greater one, because there will be greater surfaces where the slip can occur. Whatever slip there is will occur over a larger surface, and consequently produce less motion.

Prof. M. M. GARVER: It is rather curious to me that in the matter of the heat developed in conductors, generally speaking, all the heat developed in the conductor, as Mr. Heaviside looks at it, is an action around the conductor. In that connection I cannot see, if it takes place around the conductor, why the law of temperature should hold as it does in the case of metals. Take for instance the case of copper; I believe the variation is about two-tenths of one per cent. for one degree Fahrenheit. If the same law holds for 500 degrees Fahrenheit, there should be no resistance and no heat developed in the conductors. I believe some experiments have been made in regard to the conductivity of copper at very low temperatures. I would be glad to hear from any one who has had experience in this line of investigation.

Mr. A. E. KENNELLY: I think it would be unnecessary for me to add my own personal views as to what I am sure is the universal sentiment concerning the paper to which we have had the pleasure of listening. But while it is full of food for reflection from both a theoretical and practical point of view, I hope that there is one point more that may be permitted to be brought forward—that is the great difference between what might be called a working theory and an ultimate theory. Tracing back the history of any of the sciences as they are so called to-day, we see how very widespread they were, how numerous the sciences were, how in the Greek days every activity from the motion of a cloud and the motion of a body in the air, or body leaving the hand was supposed to proceed from some superior cause; and gradually, as knowledge increased and as investigation pursued its quiet path, those forces were singled out and found to be fewer and fewer, and so to-day we stand with a certain number which we still hope will be reduced and finally embodied in one. In the theory of heat, for example, there were what we call now the crudest notions prevalent about four hundred years ago as to what its nature might be. Slowly those views have become clearer, and now, perhaps, heat is in its theory more complete than any of our other sciences. But the trouble with heat has been the same as it is now with electricity—the difficulty of getting first a theory that was workable and then a theory which would account for the facts clearly and consistently. We have listened to the explanation of a beautiful theory, a theory worthy certainly of the master minds that originated it, but somehow, it does not appear as though that theory were going to be the ultimate one which would satisfy us when we come to consider nature as a whole, and that, although it is a good working hypothesis—a peg upon which we can hang our thoughts—but, after all, we may hope for some better, some clearer, some simpler and more universal distribution of matter than pulleys and spinning wheels in space. When a vacuum was supposed to be the absence of everything from space, and nature, as we read in the old books, abhorred a vacuum, gradually people began to find out that there must be something left, because phenomena took place in places that had apparently been divested of their contents which could not be accounted for if there were nothing there, and I do not suppose that any of us have any other conceptions of a vacuum further than this one thing, that actions go on there through a space devoid of ordinary matter, which we cannot conceive of acting through nothing; and gradually as light came to be considered no longer on a corpuscular theory, it became necessary to invent a new ether, and finally the question came again, If we unite the two ethers will not the same ether do for both? Then came the electro-magnetic theory of light, and that required a special ether, and that again has been united. Now, from the brilliant experiments of Hertz and Maxwell, we see clearly that those two ethers are one and the same; at least, we cannot distinguish between their properties. The ether that we suppose will propagate light is surely not one that we can readily unite with the idea of spinning wheels in space. The mere fact that the thing is difficult to conceive of is no bar, of course, to its proof. But surely we are entitled to the expectation that nature in her infinity is infinitely simple. Surely it is in this ether that we have to investigate something which unites more readily the functions of gravitation of light and of electricity. If we have, for example, a large vessel full of incompressible fluid—water will answer—and we introduce into the water two little jets, small by reference to the whole vessel, and we cause the vessel to be hermetically sealed, full of water, with the two jets in it, then if we force water out of one jet, back through the other, causing a circulation to take place through that liquid, we shall have—with the one reservation that there shall be no vortex motion in the liquid, that all the particles shall advance in ranks, shoulder to shoulder and eyes front—the lines that will be pursued by the individual particles are, strangely enough, the lines which are followed, we have every reason to believe, by magnetism by heat, in its permanent state, through solid bodies, and by gravitation. Surely there is some grand principle underlying that great class of phenomena which some day in the future will join them all into one coherent mass by which we shall see not only electricity but all the other forces of nature united.

The point just mentioned about the conductivity of copper at a very low temperature is one which has certainly a very great practical interest, although we are not likely to be able to live in a climate where, for the sake of our conductors, we can submit to two or three hundred degrees below zero. But I think that the experiments that have been made—and I have no doubt others will correct me if am wrong—experiments have been made at —40 Cent., and they showed a large increase in the conductivity of copper, and the coefficient of temperature was very much larger at that point than it was higher up the scale; and, in fact, the late Sir William Siemens had a very interesting theory, in which he assumed that the resistance at a very low temperature was a limited amount, which was very small indeed, and rose rapidly at first and slower and slower afterward. That is contrary to our orthodox views about conductivity of copper for high temperatures, but it is a view which is interesting in itself.

Mr. TOWNSEND WOLCOTT: Regarding the existence of a medium, Professor Anthony has given voice to the most general opinion in saying that action at a distance is unthinkable. I believe this is the view which Sir Isaac Newton took; but it must not be forgotten, on the other hand, that Roger Coates said that there is no *a priori* reason for disbelieving in action at a distance any more than any other experimental facts that we have, and it is this same Roger Coates of whom Sir Isaac Newton said, in speaking of his untimely death: "Had he lived we should have known something." I think that a part of the difference between these two classes of thinkers arises from their having a different conception of the meaning of the word medium. In the present state of the science, if we do not make the word medium mean too much, it is in my opinion practically demonstrated that there is a medium. If we say that action at a distance through space—vacant space—is unthinkable, what do we mean by space? If we mean simply extension, the concept of extension being simply three dimensions, it is unthinkable. You must have something more before you can conceive of it being anything else except three dimensions. But in conceiving of a medium we are too apt to make the word mean too much. Now Professor Stokes has shown that the luminiferous ether acts like an elastic solid; that is to say, that mathematics of solid elasticity apply to the ether, but in order that it should be an elastic solid which had the same degree of elasticity as the ether has, on that hypothesis it would have to be an exceedingly solid kind of a solid. I forget how much pressure there would have to be, but it is something enormous. Now, we know that the ether is not such a solid as that. Again, taking the modern theory of the action of the dielectric, of Faraday's theory we will call it, it is a stress in the dielectric. Now we may apply the same amount to this as to the other case. The mathematics of stress are equations similar to the equations of the stress in a solid body; that will apply to similar electric phenomena in a dielectric. However, there can be no real stress in the sense in which we understood the word, because the very bodies which are not susceptible of sustaining a stress are the ones which are the best dielectrics. In fact, a vacuum, which we do not consider a body at all, is a dielectric, and, according to some electricians, it is the very best of insulators, and metals which generally are capable of sustaining a great deal of stress are all conductors, and, according to the electrical theory, are bodies in which the state of electric stress cannot exist; it gives way immediately, and produces what we know as current.

Dr. MICHAEL PUPIN: I would like to make a few remarks, in the first place to express my feeling of obligation to Professor Anthony, and, with his kind permission, to add a few comments as a supplement to his review. We know what ideas Faraday had about dielectrics and the function which a dielectric had to perform in the transmission of the electric force from one part of space to another. We know that Faraday supposed the dielectric to be filled with small particles—we will not say molecules or atoms, because we do not know whether these things really exist—we say simply small particles which have the property of polarity. In what that polarity may consist we do not know. We may suppose it is of the same kind as the magnetic polarity in the case of soft iron—that every small particle is in fact a perfect magnet, having a positive and a negative pole. That theory has been worked out by Professor Helmholtz, and he reduced the equations for the distribution of the stress in the medium of the dielectric exactly the same as Maxwell did. In fact, the equations which Helmholtz obtained are a little bit fuller. Now, given that a dielectric consists of very small particles, each one having the properties of polarization, and, given, with that one property of the dielectric all the electrostatic and all the electro magnetic phenomena can be explained, I do not see that it is necessary to go any further into the consideration of any wheels working with any other wheels. To be sure, Maxwell did work out a theory, I think, in 1862, to which reference was made this evening, but he gave it up, and in his second volume on electricity he refers to this theory in a sort of off-hand way, saying that some years ago he worked out a theory of electricity on the hypothesis of Sir William Thomson, of vortex motion. It can be found there and taken for all that it is worth. Now, Prof. Helmholtz, supposing the medium to have only these properties, namely, the properties of polarization (to be sure these papers are not published yet, but I expect they will be very soon; but they do not contain anything new, because these things have been worked out before by Sir William Thomson, and I think by Maxwell at first); referring to the stress in the metal, he shows that if there is any electric disturbance, whether it be an electrostatic disturbance or an electromagnetic disturbance, that the same disturbance we have in the conductor must be propagated in the whole dielectric, because disturbance in the electric state of the conductor will cause a disturbance of the metal, and that disturbance of the metal gives the electromagnetic action.

Prof. GARVER: I see I was misunderstood in reference to the conductor. I was speaking in regard to the change due to temperature as being incompatible with that due to the action taking place in the medium inside of the conductor, and at first sight it seems that the variation in conductivity due to the temperature in the conductor was at variance with the view that the action took place outside, instead of inside, the conductor. Since thinking it over, I have arrived at what seems to be a plausible answer to my own question, that the conductor being actuated by heat, the particles are in motion due to the action of heat while in that condition. Now, as the temperature of the conductor goes down, the heat action becomes less and less, and it then approximates to what I believe it is supposed to be—a hole through the metal.

Mr. NIKOLA TESLA: I want to suggest a practical solution on which I have not taken a patent, but which is cheerfully offered in case any gentleman wants to use it. There seems to be no doubt to-day that light and electricity are one and the same, and that between both there is only a difference in degree. Now the question resolves itself into how to produce a number of undulations which would equal those of light which you can perceive. We know that if you put two coils in inductive relation you can, by passing through one coil—through the primary, say—an undulating current, produce in the secondary two distinct currents. From that secondary we can again act in the same manner upon a third secondary. I have figured that at that rate it would require about 23 conversions (laughter) starting from the highest number of undulations attainable mechanically. Probably an efficiency of 1 per cent. might be obtained by this combination, provided such a number of vibrations could be effected in a wire.

Now there is another thing I wish to mention. That is, that while we are convinced that light and electricity and electro magnetic action are the same, yet there seems to be a difference between light and electricity in this way—that we cannot maintain

light in a static state; that is, electricity which constitutes light. On the other hand we can maintain electricity so. And again light and magnetism are similar in this respect, that when we attempt to store, for instance, magnetism and light—a problem which is very interesting and would be very valuable if solved—we find similiarities. I want to say that we know well that we can magnetize a steel bar, and it will hold magnetism indefinitely. We can magnetize also a soft iron bar, and it will lose the magnetism soon. Now there seems to be, from what Professor Anthony has so admirably set forth, a possibility of producing a magnet of such qualities that it would, for an indefinite time—say, for a year, or two years, or three years—discharge continuously its magnetism upon a cessation of the current which energized it. Then we could store electricity. I attempted in my early days to do that, but it does not work. I mention it simply because I had occasion to do so. Another thing in regard to light; for instance, if we attempt to store it, as I have attempted to, we can store it for a moment; that is, if we expose certain bodies which take on light and keep it for a while. If we expose such a body to an arc light or a very intense source of light, we will find that it will take up light for the first moments, but when the light is intercepted it will instantly fall down, and the little that remains will gradually disappear, and sometimes it will take considerable time, similar to that little remanent magnetism that remains in the big bar of iron. If we plot the curve for magnetism—the intensities of the stored magnetism as ordinates and the time elements as the abscissae—we would get a curve similar to one which we would obtain by putting, instead of the magnetic, the light intensities. Yet we can take the condenser of a Leyden jar and store up electricity in any quantity, so to speak, and keep it there for a considerable time and then discharge it at will. We cannot do so with light or with magnetism, and yet we know that all these are really one and the same thing, and that there is only a difference of degree.

Dr. Pupin: I would like to ask Prof. Anthony to define his term electromotive force.

Prof. Anthony: It is one of the most difficult things in the world of which to give a definition, and I never pretended to any ability at giving definitions. We all know that in a battery there is something that develops an activity. We know that the conductor gets warm. We know that around the conductor there are what we call magnetic forces, and I believe that there is an activity set up in the whole space around it. Now, whatever that is inside of the battery that gets up this agitation I call electromotive force. Furthermore, we know that if we take a wire and move it across the magnetic lines of the force there exists something which, if that wire formed a closed circuit, will produce what we call a flow of electricity. We know it is a flow of electricity, because under proper conditions the wire will get warm; because also there are magnetic effects developed by it. There is something takes place—an agitation is set up in that wire, and I consider that something. I do not pretend to define it—I do not pretend to know what it is—but there is something there in consequence of the movement of that wire across these magnetic lines of force that constitutes what we call electromotive force. It is something, to use the language of electrical theory, that puts electricity in motion, and there is just the action I referred to in the paper, in which we may have electricity in motion (taking this theory of a current) in a conductor without any difference of potential. Suppose, for instance, I have a perfect circle formed of wire, and then I take a magnet, and suppose I thrust the north pole of the magnet perpendicularly into the very centre of that circle. We know that lines of force cut that circle all around in every part of it, and my idea is that when that magnet is thrust through there we know that a current is set up around that wire; that when that magnet is thrust through there, that whatever there is that constitutes a magnetic field acts in some way to set up this current, and acts in every part of the wire, so that there is a current set up without there being any difference of potential in any place.

Dr. Pupin: How would you measure the heat produced in the wire? Is that subject to Joule's law—the amount of heat produced in the wire?

Prof. Anthony: I should say so, certainly.

Dr. Pupin: It is equal to the electromotive force multiplied by the amount of the current. What is the electromotive force? It is that which we define mechanically in absolute measure.

Prof. Anthony: Yes, but we know it, we define it; we define it in terms of time, mass and length. It is perfectly definable. It is measured in the same terms as difference of potential, of course.

Dr. Pupin: It must be the same.

Prof. Anthony: I do not think so any more than in difference of level. We measure difference of pressure, for instance, by difference of level in case of water. To illustrate it, here I have a tube. Here we have a pump in that tube. I set the pump turning. The water before was at the same level. I now set the pump turning and the water comes down this tube and goes up that one. That difference of level will measure the difference of pressure, but that pressure was produced by turning the handle on this pump. Now the turning of the handle I call the water moving force. This constitutes a difference of potential, a difference of gravity potential which opposes my turning of the handle.

Dr. Pupin: Therefore, the work done measures the difference of level.

Prof. Anthony: It may be measured by the difference of level.

Dr. Pupin: But the work done measures the difference and the turning of the handle measures the work. In the same way the electromotive force is not a force at all in the usual sense of the word. It is the work done to make the difference of potential, and that is what the difference of potential is—the work done.

Prof. Anthony: Suppose that we do not produce any difference of potential, as in this case.

Dr. Pupin: But we do. That is a well-known problem.

Prof. Anthony: The difference of potential is equal to the work done. I might just as well say, substitute for each element in that wire an infinitely small Daniell element all around. Of course that is practically impossible, but let us suppose so. We can place infinitely small Daniell elements, connecting them together around the circle so that they will form a closed circuit. Where is the difference of potential there?

Prof. Anthony: If you have them infinitely small so that each Daniell element acts on each element of the wire, then I should say there was no difference of potential from one end to the other, and we have the electromotive force of the Daniell element producing the result entirely, and nothing else.

Dr. Pupin: But in that infinitely small battery between each pole there is a difference of potential between each two poles—in every one of those infinitely small batteries there is a difference of potential. So I may say between each one of the infinitely small elements of the wire there is a difference of potential, and they are connected in series and the current runs around.

Prof. Anthony: Let us take it in another way. Suppose there is a circular tube containing a gas or liquid, whichever you please. Now, can we not conceive of such a thing as something acting simultaneously upon every single element, no matter how many you consider there may be of them, and acting all at once so that every one of these elements will move forward at the same instant, and that there is no difference of pressure anywhere in that case? Now, difference of pressure is what I consider as equivalent to difference of potential. In other words, what we call difference of potential electrically is due to a disturbed electrical distribution, and until you have a disturbed electrical distribution there is no difference of potential. Now, in this wire where we have a perfect circle, and thrust into it the magnetic pole, if we act on every element of that wire simultaneously there is no disturbed condition of potential, and after you have stopped the magnetic pole you can conceive that your electricity has been shifted around through the whole of it without there being a disturbance there—without any difference of potential when you are through. You stop the movement of the magnet, the current stops. Your electricity does not fly back again. But let us cut that wire in two and leave an opening in it. Now force the magnetic pole through the middle and you tend to make a motion around there in the same way. Electricity is heaped up at one end, making pressure there. It goes away from there, and the moment your magnet stops the motion the electricity flies back and produces a current the other way,

Mr. Francis B. Crocker: It seems to me that the last illustration of Prof. Anthony's will give us a solution of the problem and reconcile both sides of this controversy. He assumes that the wire is opened at a certain point, and if you thrust a magnet in you will get the total difference of potential, which is a calculable quantity, and we could calculate that and predict it from known electric and magnetic effects. Now, it seems to me that when you close that you get that difference of potential spread over the entire conductor, and that difference of potential spread over the entire conductor produces the current through that resistance. Now, it is heaped up at this point of opening because it cannot pass that point, there being no conductor there. But it appears to me the same potential difference, which is what always produces a current, or rather which usually produces a current—I will make it a little less objectionable—is heaped up there; but if we close that conductor at that point, and make it uniform as regards resistance and conductivity and all other factors, isn't it natural that that potential should be distributed uniformly throughout the entire circle? But being distributed in that way, it produces the same effect as it would if it were concentrated at one point through the same resistance; and it seems to me that although there is no difference of portential which you could put off by itself, yet the same difference of potential exists throughout the circle. In other words, the integral of the difference of potential is the same in both cases, because the flow in that circuit and the C^2R—the Joule effect and all those other electrical phenomena which we understand perfectly—will be precisely that due to the difference of potential which we get when we open the circuit. I do not think there is a gentleman here who will doubt that fact, that the difference of potential which we get when we open the circuit, as assumed by Prof. Anthony, is the same potential difference or electromotive force which produces the current and heating effect, and magnetic effect, or any other electrical or magnetic effect which can be produced from that fact; and, therefore, if that heating effect which we get from the closed circuit corresponds with the difference of potential which we get when we open the circuit, is it not only natural, but almost necessary, that we have the same difference of potential spread throughout the circuit and producing a current through the same resistance? And I should say that theoretically the way to look at it was to divide it up into elements. It would be utterly impossible to treat any complicated phenomena in force without assuming them divided up into elements, throughout which elements you can make certain assumptions. That is, you have got to differentiate.

Mr. Kennelly: I think we are very much indebted to Professor Anthony for having called attention to one of the leading misconceptions of the day. There is a constant conflict between difference of potential and electromotive force, and I think nothing can be better in a society of this kind than to settle such differences. I think Professor Anthony has given us a very clear solution in this way, that whatever produces a current is electromotive force; that electromotive force may, or may not, be accompanied by a difference of potential. We do not recognize potential as we recognize current. We are led to it by a series of abstractions. Potential was introduced from a purely theoretical and mathematical basis. The potential function first existed in gravitation. It was introduced into electricity by similarities which exist between gravitation laws and electrical laws in their mathematical form, and the potential is something which causes work to be done—in virtue of which work can be done. The potential is measured by work which can be done by bringing a unit of electricity to the point where potential is measured.

Dr. Pupin: I do not agree with the last speaker that the potential is a mathematical conception any more than I would agree with him that the work is a mathematical conception. Who would say that to raise a barrel of flour to the gallery above us here was a mathematical conception? Or to charge a conductor with a certain amount of work. If we do not stick to this term, work, we cannot make a step of progress, because we cannot take in the conservation of energy. Potential is not a mathematical conception. Potential is as concrete as I am standing here. It is the amount of work done. The last speaker said that the difference of potential is something which causes the work to be done, and a little while before, that electromotive force is the cause of the electric current. Now these two thing seem to me to be one and the same, because to cause the current to flow is the work done; but I will not discuss that any more, seeing that my colleague has expoun led my idea of this circular conductor in a very nice and masterly way.

Leaving the Gas and Electric Fixture Combination.

An important announcement has been made by the Mitchell-Vance Company, of this city, in regard to their intention to leave the "fixture" pool. It is understood that they ha e been seconded by a concern in Brooklyn. Their circular reads as follows:

We have notified the Gas and Electric Light Fixture Manufacturers' Association of our withdrawal therefrom. We desire to explain to the gas and electric l ght fixture trade our position in this connection.

Since the organization in July last of the association, formed to promote the best interests of manufacturers and dealers, the undersigned have striven with their utmost ability to bring harmony into the association, and used all their efforts to advance the welfare of the trade, whether it concerned the making and selling of goods or in promoting the relations of our customers with the association. Therefore, we had hoped for its continuance upon a similar basis to that of the past half year, as it had proved so advantageous to all. Very much to our regret we found influences being exerted in the association in favor of a trust, and the formation of the National Gas and Electric Fixture Company has been the result.

The terms of the agreement under which the association was originally formed have been violated to further the interests of this company, which has sent circulars to our customers, stating that goods ordered from manufacturers must be sent through the company, a method of business, to say the least, complicated and unnecessary.

Representatives of our company were induced to attend some of the early meetings of the incorporators of this company under a misunderstanding of its objects and intentions. We have no interest in the National Gas and Electric Fixture Company, and it has been requested to withdraw from its letterheads and other papers the name of our Mr. Mitchell wherever it appears. We naturally prefer to keep control of our own business, and with the assistance of our customers we propose to prosecute it in a legitimate manner, supplying a full line of goods to meet all requirements, the artistic merit, quality and finish of which will be fully maintained at prices as low as consistent with a living profit, taking care, as always heretofore, to protect the trade when supplying our goods to their customers.

Electric Light and Power Among the Mormons.

The progress of electrical work in Utah and Wyoming during the past year consists in the following installations and increases, namely: Park City, Utah, an Edison central station, 1,000 lights capacity, which is working at present under full load, and is exceedingly prosperous; an isolated Edison light station, 500 lights capacity, at the new Union Depot, in Ogden, Utah, which station supplies light for the depot building, yards and switch lamps. The Deseret Agricultural and Mechanical Society also purchased a 175-light Edison isolated station for lighting their Exposition building in Salt Lake City. These stations were all supplied and constructed by R. M. Jones, Edison and Sprague Companies' agent for Wyoming and Utah. The United Electric Company have wired several large business houses in Salt Lake City for the application of multiple incandescent lights, with a prospect of a central station being located in the vicinity. The Salt Lake City Railway Company have built 11 miles of Sprague electric railway through some of the principal streets of Salt Lake City, and have about six miles of extensions under course of construction. They have 15 Stephenson 16-foot cars equipped with Sprague motors, and five additional cars ready for placing on the road at any time. Thirteen of the above cars are equipped with single motors, type No. 6, and seven are double motor cars of the same class. Their station equipment consists of a compound tandem Fraser & Chalmers' Corliss engine, 240 h. p., and two No. 32 Standard Edison railway dynamos 80,000 watts capacity each. The railway has given such thorough satisfaction from the first that it is probable Salt Lake City will have 30 miles of road and 40 to 50 electric cars in operation at the close of the coming summer. This station and equipment (except engine) was constructed by R. M. Jones, who represents the Sprague interests in this district.

He has also provided and set one three and one 10 h. p. stationary Sprague 500 volt motors, and has contracted with the city for one 30 h. p. motor for driving a sewer pump, to be in operation early in March. These motors receive their current from the street railway circuits, and the prospects are fair for many applications of stationary motors in the near future.

The Salt Lake City Light, Heat and Power Company have added 31 Brush arc lamps to their street lighting service and a number of interior lights have been placed. This company is also operating about 300 Heisler 30 c. p. incandescent lamps. This station was one of the first Brush central stations built, but it is giving very good service. At Ogden, the arc light station has had serious trouble with the water power freezing up at various times during winter, and in consequence a company has been organized and arrangements completed for constructing a 3,000 light Edison central station directly in the city, which will be in operation early in June.

A thorough fire-alarm system has recently been constructed in Salt Lake City by the Gaynor Company, by Mr. Stockwell, foreman. Salt Lake City is more thoroughly infested with pole lines and overhead wire systems than almost any other city in the country, New York City before the "downfall" not excepted. The streets are 132 feet wide and pole lines are usually in the centre of the streets. However, the citizens are talking strongly of uniting in the effort to supply light through the business district with the Edison underground system.

The telephone interests are well represented by central offices in Salt Lake, Ogden, Provo, Park City and other smaller towns throughout the country, and all of them are connected by toll lines. The Brush station at Cheyenne and the Edison stations at Laramie and Evanston continue with their usual prosperity, but with no material increase in capacity. All the Edison stations in this district are driven by Ide engines, all of which give perfect satisfaction.

The Union Pacific Railway Company have decided upon an electric transfer table and overhead traveling crane, also a 500-light incandescent station in their new locomotive shops at Cheyenne. The system is not yet adopted, except for the transfer table, which will be driven by a 15 h. p. Thomson-Houston railway motor.

"Junius."

American Engines for Electric Lighting in England.

The Metropolitan Electric Light Company operates a number of large central stations in the city of London. One was recently equipped with an outfit of four 14 and 24 by 14, Westinghouse compound engines; two 10 and 18 by 10, Westinghouse compound engines; one 12 and 20 by 12 Westinghouse compound engine.

Another station operated in the same city by the same company is equipped with single-acting engines of English make. Quite a good-natured rivalry exists, of course, between the men who are in charge of these stations. Recently, the American engines were put through their paces by British experts, on behalf of the Metropolitan Company, in a test lasting twelve hours without intermission. It was amusing, says the Westinghouse Machine Company, to see the interest taken in this test by the American colony in London, many members of which spent the greater part of the day in the station. Even our respected Minister Plenipotentiary and Envoy Extraordinary, Mr. Lincoln, was on hand to see the American Eagle properly comforted and encouraged in its hour of trial. Being called away on important business he returned at a later hour, in order to make sure that American interests and American dignity were being properly upheld. The engines in question are running regularly under a very heavy service, and the experts subjected them to many severe tests during the day; but they behaved so splendidly in all respects that the Englishmen were agreeably surprised. Some of the Americans who took such a lively interest in this test really knew very little about steam engineering, but they were wildly enthusiastic at the way in which these engines upheld America's reputation for good machinery in London. Already orders have been sent to the Westinghouse Machine Company, at Pittsburgh, for one 18 and 30 by 16 Westinghouse compound engine; one 14 and 24 by 14 Westinghouse compound engine; one 10 and 18 by 10 Westinghouse compound engine; one 9 and 15 by 9 Westinghouse compound engine, for the same London station, so that it is fair to assume that this type of engine is giving satisfaction in the "tight little Isle." There are also rumors afloat that the other London station of the Metropolitan Company, which is now equipped with English engines, will soon be supplied with Westinghouse compound engines from Pittsburgh.

More Sprague Electric Railways.

The mid-winter is not generally considered by street railway construction companies to be the most active and busy time of the year. The conditions of soil and weather are unfavorable for outside work, and the amount of business to be performed by the street railway companies is not so great as in the summer months, and does not encourage extensions. But with the prominent electric railway companies the season seems to have no effect upon the amount of business contracted for and under construction, unless it is to increase it. We are advised by the Sprague Electric Railway and Motor Company that winter has made no difference with its business, and that during the last few months an unusually large number of contracts has been closed for electrical apparatus, and that construction work will go on right through the winter.

A list of the roads which have ordered equipments from this company illustrates in a striking way the remarkable confidence which street railway managers feel in the electric system, and is indicative of a widespread adoption throughout the country by street railway companies of electrical apparatus. Among the most recent contracts of the Sprague company may be mentioned the following: Salem, Ohio, Capital City Street Railway, two cars; Davenport, Iowa, Davenport Electric Street Railway Company, four cars; Dubuque, Iowa, Electric Light and Power Company, 10 cars; Chicago, Ill., Cicero & Proviso Street Railway, 12 cars; and the following additional orders from street railway companies already equipped by Sprague or other systems: Sioux City, Iowa, Sioux City Electric Railway, three cars; Milwaukee, Wis., West Side Street Railway, nine cars; Des Moines, Iowa., Des Moines Electric Railway, two cars.

The Electrical "Afreet."

Everybody knows the story of the terrible Afreet in the "Arabian Nights," whom the incautious fisherman liberated from the bottle in which he had been imprisoned, and whom the fisherman circumvented, only by getting him back into the bottle. From the way in which some people talk and write of the danger of electricity, as an illuminator and a motor, says Julian Ralph's bright new paper, *Chatter*, one would suppose that modern civilization had another Afreet on its hands, which it could only restrain by having the monster bottled up again. Even so it was in the infancy of the steam engine, when the predicted slaughter of vagrant cattle elicited George Stephenson's celebrated *mot* about the "coo" coming off second best from a collision with the locomotive. But we have long since ceased to regard steam in any of its applications as a devouring Afreet. In fact, we trace to it all the progress which makes the century what it is, and which most clearly differentiates it from all the centuries that have preceded it. Men are killed by the agency of steam every day, just as they are killed by falling down stairs, or by being asphyxiated by gas. Merely human agency figures very largely in the sum of casualties, and the perversity of inanimate objects has a most impressive tale of slaughter to answer for. During 1889 there were 1,467 deaths from violence in New York City. Of these 265 resulted from falls, 36 from blows of falling objects, 12 from being run over by horsecar, 33 from being run over by cars and engines, 32 from being run over by wagons and trucks, 12 from asphyxiation by gas, and nine from electricity. Considering the wide diffusion of electrical appliance of all kinds, this is not a very alarming showing for the newest agent that has been devoted to the service of man.

For Boston the showing is even more suggestive. According to the last annual report of the board of health of that cultured and well-governed town, the total number of deaths from casualties during the year was 399. Of these, the railroads were responsible for 78, 60 persons were drowned, 13 were run over by vehicles, 9 were killed by elevators, 12 died from the effects of heat, and no less than 78 were killed by simply falling down, of which 16 fell downstairs, 7 fell on the sidewalk, 6 fell from buildings, 5 fell from teams, 4 fell on the ice, 1 fell from a chair, 1 fell from a tree, 1 fell from a bicycle, and 1 fell from a fence. Not a single death is recorded against electricity.

There are in New England 175 central electric lighting stations, which have been in operation from one to ten years. They generate immense quantities of energy and distribute thousands of horse power by wires through and over all the principal cities and towns. Since the first of these stations was established there have been but five deaths from electricity. In the same period, the steam railroads of New England have killed or wounded 5,241 persons; of whom 2,339 were railroad employés and 2,902 belonged to the general public. Of the five deaths from electricity, four were employés of the lighting companies and one only was a member of the outside public.

On the whole the electric Afreet does not appear to be a sanguinary monster, for the figures show that electric energy is absolutely safer than any similar quantity of energy used in the industries of the country.

But there is another "bogey" conjured up by the alarmists. When a fire is caused by some unknown agency, it is usual to attribute it to electricity. To return to the Boston statistics, always carefully kept and thoroughly digested. In the Fire Marshall's report from Nov. 8, 1886, to May 1, 1887, there is a detailed record of 344 fires, of which only 5 are returned as "cause unknown." The kerosene lamp caused 32; rats and matches are responsible for 11; dropping of matches, 27; children and matches, 13; careless use of matches, 12; overheated stove, 16; hot ashes from tobacco pipe, 10; lighted cigar stump, 6; sparks from locomotive, 3, and electric wires, 3. Electricity caused .009 of the fires. For 1888 we find the same record for kerosene—matches and rats and matches—while electric wires are responsible for .607 of the fires. In the 1889 report, sparks or heat from furnaces, locomotives, steam pipes, etc., are responsible for 14 per cent. of all the fires; kerosene stands well up with 13 per cent., while matches, in conjunction with men, rats, and children, are responsible for 20 per cent. of all the fires. Electricity comes in with a modest 2 per cent., being on a par with hot ashes, and twice as harmless as firecrackers and fireworks.

There have been sundry sensational publications lately in regard to the danger to be apprehended from electric railway wires. As these carry a fixed current of only 500 volts, the quantity of electricity varying with the number of cars running, and as no man, woman or child was ever seriously injured by a 500-volt current, it is not easy to see where the "deadly railway wires" come in. Every alleged case of death or injury by railway wires has, upon investigation, been shown to be without foundation, or to have been caused by the arc current. The case of the colored boy said to have been killed by the railway wires at Chattanooga is one in point. He was found in a pit beneath the car he had been employed to clean, with his clothing on fire and an overturned oil lamp between his legs. He burned to death. This occurred in the night, an hour and a half after the road had ceased running and the power station had shut down. There was no current in the wires, and had been none for an hour and a half.

As to danger of fire from railway wires, since they enter no buildings they cannot of themselves cause fires. The current might be conveyed through a clock or telephone circuit by wires falling on the trolley wires. Without discussing the law and equity of requiring such wires where they cross the streets or cross other wires to be so put up that they will be safe, it suffices to say that by the use of insulated guard wires, falling wires are prevented from coming in contact with the trolley wire, and the chance of a railway wire causing a fire either directly or indirectly is so remote that it will probably not be found worthy of a separate classification.

The Kansas City "Electric Limited."

All who propose attending the Electric Light Convention at Kansas City and have not yet secured accommodations on the special "Electric Limited," which will leave the Pennsylvania Railroad station, Jersey City, on Sunday morning next, Feb. 9, at 9.45, should communicate at once with Mr. C. E. Stump, chairman New York Transportation Committee, *Times* Building, New York. The fare going, including sleeper, is $39.75.

The Transportation Committee will be at the Electric Club on Saturday, Feb. 8, from 5 to 10 P. M., to furnish tickets and berths to those who are not able to secure them before that time.

The New Quarters of the Central Electric Company.

Just within the northern borders of the wholesale section of Chicago, and at a point easily and quickly accessible from all the depots and principal hotels in Chicago, the Central Electric Company have established their new headquarters, where they will welcome all who may call to observe how thoroughly equipped they are for supplying whatever may be required in the operation of light or power plants or in any branch of the electrical industries, whether it be a reflecting galvanometer or 100 miles of Candee wire.

The wisdom shown in selecting their present location is quickly apparent when it is remembered that the handsome Telephone Building is but a half a block north, while a block to the west is the station of the Chicago Arc Light and Power Company.

The building is located at 116 and 118 Franklin street, corner of the court between Washington and Madison streets. The full depth of the store is 100 feet and the width 50 feet. The total available floor space amounts to over 15,000 square feet. The walls are handsomely finished in cream, with a neat border and ceiling piece to match; a new floor of hardwood has been laid; the partitions, shelving, counters, drawers and bins are of red cherry; the show windows, with eastern exposure, are unusually spacious, affording an excellent opportunity for the attractive display of all the new goods. Upright wall cases and long counter show cases are filled with a complete line of standard measuring and testing instruments; deep bins hold thousands of feet of duplex incandescent cord in all colors and combinations of colors; the various sizes of hard rubber, whether of rod, tubing or sheet, are carefully protected from injury in special compartments, the extensive business done in this one article being indicated by the heavy stock carried; in soft rubber tubing the same care in assorting is also shown; various compartments are filled with batteries of all the standard makes and types, with bells, push buttons and other house goods. The shipping room is in the rear of the sales department, and contains every device that will facilitate the rapid handling of supplies going out or coming in, ample egress being afforded by the various points of exit. Connecting the basement with the sidewalk is the usual curved slide, while a powerful elevator driven by a constant potential motor of five horse power, is also in operation. In the basement are barrels of glass insulators of all forms, cross arms, pins, brackets, etc., though the supply of the latter is limited, owing to the fact that shipments can be as promptly made from their own factory at Columbia City. In the basement are also the heavy copper conductors, etc., while the main stock of the lighter wires is on the fourth floor, each size being separated from the other in bins 6x6x4 feet in size. It would need but a single visit to this floor to convince the contractor of the company's ability to fill promptly any order that may be received, as there are miles of Okonite and Candee wires, with stacks of Okonite rubber tubing, Manson tape, etc. On the floor below is the usual supply of underwriters wire, galvanized iron wire, etc.

The guidon the Central Electric Company have thrown to the breeze is a twelve foot wire sign standing out from the top of their building with the magic word "Okonite" so clearly defined against the sky that it can easily be read at a distance of more than a mile.

As now constituted, the officers of the company are W. H. McKinlock, president; G. A. McKinlock, vice-president and treasurer, and F. W. Cushing, secretary. F. DEL.

The Western Electric Railway Association.

The Western Electric Railway Association met in session at the Grand Pacific Hotel, Chicago, at 10 A. M., Wednesday, Jan. 29, and after the transaction of routine business, outlined the programme of proceedings for the annual meeting to be held on June 11 or 12, either in Cleveland or Chicago, the question of location being left unsettled till a greater number of delegates could be heard from.

A committee consisting of T. J. Evans, president of the Ottawa, Ill., Electric Street Railway Company; C. E. G. Johnson, president of the Lafayette Street Railway Company, and Dr. W. L. Allen, president of the Davenport, Ia., Central Railway Company and secretary of the Association, were appointed to gather and compile such statistics as could be secured covering the operation of electric street railways, and to secure from representative superintendents of railway lines papers covering the following topics:

1. The comparative cost of operating street railway lines using animal power and electric power.

2. Mechanical repairs required on motor cars, with special reference to the type of gearing, its life, and whether noiseless or otherwise, as well as repairs on trolley poles, springs, etc. Cost of same.

3. Repairs required in the electrical machinery, motors, switch boxes, etc., and also on overhead circuits.

4. The comparative depreciation in value between lines operated by animal power and electric power. In connection with this subject, it should be borne in mind that the usual rate of depreciation is 10 per cent. which is too great an allowance where first-class machinery is installed, as experience has demonstrated that a depreciation of 5 per cent. in such cases is nearer correct.

5. The comparative value of safety brakes, with statistics showing type of brake employed, whether the shoe used is metallic, and if not, what material is used, and full mechanical details. In this connection the following questions would be proper ones to ask: Has the brake employed always held the car firmly when applied as car was passing over slippery rails? Has the action appeared to strain the car or to cause a shaking motion, and does the brake take hold suddenly or gradually? At what distance will it bring the car to a complete stop? Cost per car equipment.

It is to be regretted that a larger number of superintendents do not come forward with a supply of facts regarding their actual experience in operating roads, as the compilation of such statements would be of practical value to all without working the slightest injury to any. The day is fast coming when that bugaboo, the undetermined factor of repairs to motors, will be found to have but slight existence, and the quicker it is caused to disappear under the rehearsal of the cold facts of everyday experience, the more quickly will the average street railway appreciate the commercial value of electric power systems and hasten to adopt the same, not to benefit the public with a means of rapid transit, but to put money in the purse.

Quite to the point is the following letter from Mr. Albert Walton, an experienced business man of Omaha, to Mr. George R. Nimmons, of St. Paul, and it is worthy of note:

"I am glad to see that your council has accepted Mr. Lowry's substitute for the cable on Washington avenue and other streets. We have both here, and since the electric lines have been running—the one between Omaha and Council Bluffs, about five miles commenced Nov. 1, 1888, and our city system, now embracing about forty miles, commenced running about Aug. 1—we have had a more satisfactory service than the city ever had. The stoppages on the cable are more frequent, causing delays from twelve to eighteen hours, and the longest stoppages on the electric lines not over two hours.

"There is one thing regarding Washington avenue in the arguments pro and con which I have not seen mentioned: That street is crowded for many blocks; the cable motion is a steady one, running at the same speed all the time, while the electric system is the opposite, and cars can move along as slowly as Mr. Lowry's mules. This, on that street, is absolutely necessary. Again in the suburbs, they can increase their speed to that of a railroad train, whereas your cable has to go just so fast all the time.

"The pleasure in riding in electric cars is much greater than on cable, and even now, long as our system has been operated between Omaha and Council Bluffs, I really believe 10 per cent. of the traffic is that of pleasure. I live about two miles from my office here, and in that distance the old street cars consumed twenty-five minutes; our new mode makes it in fifteen minutes. No one thing can be done in Minneapolis that will advance suburban property so much. Such has been the result here. It means fifteen to eighteen minutes from Sylvan Park, in North Minneapolis, to the Nicollet House, which means very soon $1,000 per lot for that property."

The John Scott Medal for the McIntire Joints.

We are glad to print herewith the report of the Franklin Institute awarding to the late Mr C. McIntire the John Scott medal and premium. Although Mr. McIntire did not live to receive the medal, he had the satisfaction of knowing he had won it, and it will now, with the check for the premium, be the more highly prized by his family as a memento of him.

No. 1434. HALL OF THE FRANKLIN INSTITUTE, PHILADELPHIA, March 26, 1889.

The Sub-Committee of the Committee on Science and the Arts, constituted by the Franklin Institute of the State of Pennsylvania, to whom was referred for examination

MCINTIRE'S PATENT ELECTRIC WIRE CONNECTORS,

Report:

The invention was made by Charles McIntire, of Newark, N. J., and is described fully in Letters Patent No. 347,625, dated Aug. 17, 1886.

In consists in joining the ends of two wires, without soldering, by means of two thin metal tubes placed side by side, and soldered or otherwise joined together, into which the wires are inserted from opposite directions, the lengths of the tubes, the covering and inclosed tubes being then twisted together a greater or less number of times, as may be desired.

The result is a joint of increased tensile strength, and, for electric wires, of better conductivity than by the usual method of uniting telegraph and telephone wires. Such a joint can be made with ease and rapidity as compared with any other method, and is or can be made to be equally as good as a soldered joint. The metal tubes completely inclose the wires, and there is more than double the surface contact than when they are simply twisted together. The torsion also compresses the surfaces of the tubes and wires to such a degree as to practically exclude air and moisture; the oxidation of the surfaces will therefore proceed at a very slow rate, and the conductivity of the joint will be maintained indefinitely.

The sub-committee are of the opinion that Mr. McIntire's invention is a valuable improvement upon former methods of connecting wires, especially as regards economy and strength, and, therefore, recommend the granting of the John Scott legacy premium and medal to Mr. McIntire, as a recognition of its merits.

(Signed), E. ALEX. SCOTT, Chairman Sub-Committee;
EDGAR CROASDALE,
MURRAY BACON,
N. H. EDGERTON.

Adopted July 5, 1889.

S. LLOYD WIEGAND, Chairman.

Certified to be a correct copy from the records.

WM. H. WAHL, Secretary.

Special Correspondence.

NEW YORK NOTES.

OFFICE OF THE ELECTRICAL WORLD, 167-177 TIMES BUILDING, NEW YORK, Feb. 3, 1890.

The Edison-Lalande Primary Battery is in great demand, and over 1,000 cells, I am told, have been put in use since December.

Chas. R. Vincent & Company. 15 Cortlandt Street, New York City, agents of the Ball Engine Company, have just delivered a 35 h. p. engine to the Brooklyn Navy Yard, for the new electric light installation.

The National Electric Protector Company, 16 and 18 Broadway, are rushing their protectors, and are encouraged by the orders they receive. New Bedford, Mass., has recently ordered a number for their fire department. At Chelsea, Mess., 35 have already been put in on the fire circuits and the whole system will be equipped.

The Porter Teletype Company, 30 Union square, have installed a 300 number teletype instrument in the Hotel Dam, which Mr. Dam says is giving perfect satisfaction. There is no running to the annunciator to push up the drop. It operates the same as a stock printer, printing the name of the article you want, from a policeman to a hot Tom and Jerry, and the number of your room, in good large type.

H. A. Rogers, dealer in general manufacturing and electrical supplies, is doing a good business at the old stand, 19 John street, New York City. As Mr. Rogers only handles goods of a high known quality, and gives the best attention to all orders placed with him, this prosperity is most natural and deserved. This gentleman is the sole United States agent for Moncrieff's celebrated Scotch gauge glasses, and does an enormous amount of business in these goods alone.

Mr. Augustus Noll, of 10 and 12 East Sixteenth street, this city, tells me that in connection with the manufacturing of appliances he has secured the exclusive right to manufacture and sell the Barriett motor. A company is now being organized, which will be capitalized for $100,000. They propose to do a general electrical manufacturing business, and equip their factory with the latest and best machines for such work. They have taken in this motor, and think it is the best in the market.

The Standard Thermometer Company, 18 Cortlandt street, are hustling for business, and have secured several big orders lately for thermometers for advertising purposes. Special orders have been secured to fit out one of the schools of this city with thermometers. These thermometers, telethermometers, telehydro-barometers, telemeters, etc., are used to show temperature, height of water, pressure of steam, gas, etc., and indicate it any distance, from one foot to thousands of miles.

W. H. Harrison, Manager for the Lodge-Davis Machine Tool Company, 64 Cortlandt street, reports an exceedingly good demand for their specialties. He has sold an outfit to the Rollstone Machine Company, Anniston, Ala., and fitted out a large number of other shops. They are carrying other makes of machine tools for all purposes particularly adapted to electrical manufacturers. Mr. Harrison speaks most encouragingly of the outlook for business, and reports sales the past month to be very healthy.

The Hill Clutch Works, through their Eastern manager, Mr. Walter C. Wonham, inform me that they have closed a contract with the Brush Electric Company, of Cincinnati, O., for the complete equipment of their new plant with "Hill" friction clutches and power transmission machinery. They have also secured the contract for the equipment with their machinery and clutches of the electric light plant to be installed in the New York Life Insurance Company's new building in Minneapolis, Minn.

New York Quotation Company.—At a meeting of the stockholders of the New York Quotation Company, purchasers of the Commercial Telegram Company's tickers, held at No. 1 Broadway, on Jan. 28, the following persons were elected directors Robert J. Kimball, Charles Merritt, George G. Ward, John O. Stevens, Edward C. Platt, William H. Baker and A. B. Chandler. The directors elected the following officers: A. B. Chandler, president; George G. Ward, vice-president, and George W. Casper, secretary and treasurer.

The Complete Electric Construction Company, 14 Cortlandt street, have secured a large contract to install a Heisler plant at Union Hill, N. J., for street and commercial illumination. The business opening up there promises to be very large, as the territory includes Weehawken, West Hoboken, West New York, South Bergen and Guttenberg, with a population of fully 40,000. The Complete Company are also very busy installing cables in the subways of New York, running five to six gangs of men and using the Seely patent tee joints and connectors.

The Seely Manufacturing Company, 14 Cortlandt street, are actively filling orders for their underground, submarine, house and "tee" connectors and continuous joints for wires and cables, as described in THE ELECTRICAL WORLD of Feb. 1. They have also just brought out a new arc lamp flexible cord insulating screw eyes for suspending lamps, etc., and avoiding dangerous contacts. The loop of the eye is spread open to allow of the advantages of a hook. The screw is gimlet pointed, so that it can be let into any wood by hand. The company expect to find a large field for their specialties.

Mr. Norman Hubbard has just received a fifth order from the Sawyer-Man Electric Company for a 12 × 12 inch duplex Packard vacuum pump for use in their Twenty-third street factory. These pumps are probably the only ones of this size ever built that produce a dry vacuum of twenty-nine and three-quarter inches. Some of them have been in use over two years, most of that time running day and night and requiring no special attention. They are used for operating automatic mercury pumps, of which one easily handles 150. The demand for the smaller sizes of the Packard pumps continues unabated.

The Anglo-American Electric Light Manufacturing Company, of this city, has just elected the following directors: W. P. Ward, Lyon Manufacturing Company, 59 Fifth avenue, New York City; Orson Adams, President Commercial National Bank, New York City; Henry E. Simmons, President American Investment Company; Henry Steers, President Eleventh Ward Bank; H. M. Munsell, President National Alliance Insurance Company; E. D. Woodruff, President Logan Silk Mills, Auburn, N. Y. (Treasurer); Edmund H. Sentenne, Contractor, 132 Nassau street, City; Julio Merzbacher, New York Life Insurance Company; L. Lehmaier, 28 Greene street, New York.

Standard Underground Cable Company.—A meeting of the stockholders of the Standard Underground Cable Company was held in Pittsburgh, Jan. 23, and a meeting of directors on the succeeding day. All the old officers were re-elected, viz: George Westinghouse, Jr., president; C. H. Jackson, vice-president and general manager; John H. Dalzell, treasurer; J. W. Marsh, secretary; Elmer L. White, auditor and assistant treasurer. The following were elected directors: George Westinghouse, Jr., Robert J. Pitcairn, Caleb H. Jackson, Mark W. Watson, John N. Dalzell, Joseph W. Marsh, Henry Snyder. An extremely favorable report of the year's business was rendered indicating a net profit of 11 per cent. on the par value of the capital stock. The company starts upon the new year with orders in hand aggregating nearly $150,000. A dividend is announced for April 1.

Mr. E. T. Lynch, Jr., has secured the contract for lighting the city of New Berne, N. C. This contract not only covers the exclusive franchise for lighting the city, but includes the operation and construction of a street railway system. The plant will consist of two 100 h. p. boilers, two high-speed engines, a 50-arc light dynamo and lamps, and about fifteen hundred 16 c. p. lamps, a large number of which have already been subscribed for. This makes the fourth central station contract that Mr. Lynch has secured within the last sixty days. He will use either the three-wire or the alternating system, the best weatherproof wire of high insulation test, and make the entire plant a model. The station will be a brick building 75 × 40. The site for the station gives great facilities for the handling of coal, either by railroad or water transportation. The poles for the line circuits will be of cedar.

Bad Line Work in Street Lighting.—Upon arriving in Newark this week via the Pennsylvania R. R. and glancing out of the window upon arriving at the Centre Street station, I saw several arc lamps. To my astonishment, all the connection the circuit had with the lamps to supply them with current were two eyelets with the conducting wires brought through the eyelet, the weight of the lamps forming the contacts. Just imagine the resistance forming there on a wet, stormy day. I should think the swinging of the lamps would cause bad arcs. An electrician of repute informed me that he has stood on the corner of Broad and Market streets, where, overhead, the air is filled with cobwebs of wires of all kinds, and has seen arcs form among the wires, caused by the swaying of the wires by the wind. This matter should receive the immediate attention of the electric light and other companies in Newark before the Board of City Works swoops down upon them. W. T. H.

NEW ENGLAND NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD, Room 8, Cook Building, cor. Franklin and Congress Sts. BOSTON, Feb. 1, 1890.

Mr. George H. Roe, of the California Electric Light Company, of San Francisco, was a visitor at the Boston Electric Club this week.

The Wright Electrical Engineering Company's men are now at work in Milton, Mass., and will start in Clinton, Mass., within a few days.

The Bell Telephone Company reports a net output of 1101 instruments for the first month of the new instrument year, as against 1,917 in 1888-89.

Fire Marshal Whitcomb, of Boston, has presented a report on the recent fire there, in which he says that there is no certainty as to the origin of the fire, but that he believes it to have been caused by electric wires.

Canton, Mass.—The Canton selectmen held an adjourned hearing on the electric lighting question this week on the petition of the Blue Hill Electric Light Company. It is expected that the capital stock, $20,000, will be paid up next week.

The New England Wiring & Construction Company have contracted with the West End Street Railway Company to wire the Grove Hall and Eggerston Square Stables. About 430 lights will be used in the former and 130 in the latter.

Professor A. E. Dolbear, of Tufts College, delivered a lecture at College Hill last Monday evening, which was well attended.

Professor Dolbear took the wide subject of "electricity" as his theme, and was listened to with marked interest by all.

Hudson, Mass.—There has been a strong petition made to the Legislature opposing the scheme of connecting Hudson with Marlboro by an electric railroad. The opposition comes chiefly from the steam railroad people, who now have a road between these two towns.

Mr. William D. MacQuesten, of New York, was in the city this week, and was warmly received by his numerous friends. Many have been the inquiries for "Mac" for the past few months, and all were glad to have an opportunity of seeing him again, if only for a short time.

Boston's Street Lights.—The street lighting of Boston practically rests *in statu quo*, no decision having yet been rendered by the Board of Aldermen. The public hearing before the Board of Aldermen comes up on Monday, Feb. 3, and it is expected that the question will be fully discussed.

Whitman, Mass.—At a hearing by the selectmen in Whitman this week, it was voted by 57 to 4 to authorize the selectmen to issue a franchise to the petitioners, giving them a right to build the road, and to adopt either the trolley or storage battery system. The trolley system will probably be adopted.

Providence, R. I.—The Pawtucket Cable Tramway Company have applied to the general assembly for a railroad to be operated electrically. The road will traverse East avenue and tap the Providence Cable Tramway Company's line on Waterman street, opening up an entirely new section of real estate.

Newport, R. I.—The Newport Street Railway Company held its annual meeting this week and elected the following directors: A. C. Titus, A. S. Sherman, T. T. Pitman, Eugene Griffin, J. T. Burdick. It was voted to petition the General Assembly to amend its charter so as to allow the capital stock to be increased from $100,000 to $200,000.

Malden, Mass.—At a meeting of the Common Council, held this week, the committee on street lights asked for an appropriation of $18,000 for the current year. Its report states that there are 90 arc lights and 485 incandescent lights. All the oil lamps have been replaced with electric lights. During the past year the cost of a gas light was eight cents per night, while the incandescent cost but six.

J. A. Grant & Co. have received an order for the installation of a 125 h. p. McIntosh & Symour high-pressure engine in the Shoe & Leather Association Building, Boston, for operating the Mather system recently put in by Clafflin & Kimball, of this city. The Evans system of frictional driving will, in all probability, be used, giving, as it does, an immense saving in floor space over other methods.

Hingham, Mass.—At a special town meeting held in Hingham, Mass., the question of whether the town would make a contract with the Weymouth Light and Power Company to light the streets of Hingham was referred to a committee of five, to report at the annual March meeting, and until after that meeting the company is requested to continue to light the streets at a price to be decided by the committee and the company.

Wainwright Manufacturing Company, of Massachusetts, are circulating among their friends a very neat memorandum tablet made of celluloid, with a beautiful engraving of their famed feed-water heater on the front in black and gold. All engineers should possess themselves of one of these interesting and tastefully designed tablets, which, besides being extremely useful, is an ornament to any one's pocketbook.

Mr. George W. Davenport, General Manager of the Thomson-Houston International Electric Company, left Boston last Tuesday, to be gone for six or seven weeks, for a trip in Cuba and Mexico. Mr. Davenport will go direct from New York to Havana, thence to Cardenas and then to Mexico, making a general inspection of the numerous plants in these countries, installed by the International Company, and in the interests of any new business which may develop in these profitable fields.

Roland T. Oakes & Co., of Holyoke, Mass., have just completed extensive improvements in the Hotel Hamilton, at Springfield, Mass. Two hundred chandeliers, each having 16 Edison incandescent lights, have been placed in the dining room, and the effect is much enhanced by the use of reflectors and crystal prisms. Roland T. Oakes & Co. have complied with all the requirements of the New England Insurance Exchange, and are using extensively the interior conduits of the Interior Electrical Conduit Company of New York.

The Thomson-Houston Electric Company reports the following sales of arc apparatus to central stations: Franklin, Tenn., 20; Butte, Mont., 30; Rochester, N. H., 105; Kokona, Ind., 70; Bedford, Ind., 50; Long Branch, N. J., 100; Wilkesbarre, Pa., 50; Lowell, Mass., 25; Atlanta, Ga., 50; W. Superior, Wis., 50; Martins Ferry, O., 20; Johnstown, Pa., 50; Hyde Park, Mass., 50; Spokane Falls, Wash., 50; Petaluma, Cal., 50; Omaha, Neb., 100; Denver, Col., 70; Richmond, Mo., 15; Joliet, Ill., 35; Nashville, Tenn., 300; Mt. Clemens, Mich., 30; Cheboygan, Mich., 30; Bluffton, Ind., 50.

The Thomson-Houston Electric Company reports the following sales of incandescent apparatus to central stations: Franklin, Tenn., 300; Northampton, Mass., 650; Chatham, N. Y., 650; Beverly, Mass., 650; Great Falls, N. H., 1,300; Punxsutawney, Pa., 650; Sandy Hill, N. Y., 650; Petaluma, Cal., 650; Muscatine, Iowa, 650; Battle Creek, Mich., 650; Langhorne, Pa., 500; Belfast, Me., 300; Auburn, N. Y., 1,300; Meriden, Conn., 1,300; Paris, Ky., 1,300; Long Branch, N. J., 650; Jacksonville, Fla., 650; Wallace, Idaho, 650; Millbury, Mass., 650; Brandon, Vt., 650; Butte, Mont., 650; Springfield, Ill., 650; Fresno, Cal., 650; Nashville, Tenn., 2,600; Ann Arbor, Mich., 650; Watsonville, Cal., 300; Mt. Clemens, Mich. 650.

Nashua, N. H.—The annual meeting of the stockholders of the National Gas and Electrical Construction Company was held in this city this week. A board of directors was elected as follows: George H. Drew, Frederick M. Smith, Edward F. Houghton, Lucius M. Childs and Fred J. Hutchinson, of Boston. This company was organized for the purpose of contracting for the construction and equipment of electric and gas stations and electric street railroads. Among the many electric light plants contracted for by this company is Danielsonville, Conn., which is now almost ready to start up its lights. This company has at present some seven franchises for installing electric light plants in various cities in New England, and has a bright prospect before it for the opening year.

A Novel Lag Screw Wrench.—The Lowell Wrench Company, of Worcester, Mass., are introducing to electric engineers an extremely useful tool in the shape of a lag screw wrench. The wrench is made to fit the heads of ordinary lag screws, commonly used for bolting crossarms to poles, and for holding down any piece of machinery. So long as the screw runs easily it can be turned by the wooden handle by means of the fingers and independent of the ratchet. When this can no longer be easily done, the handle is used by which an immence purchase can be had, and all this can be don without removing the wrench. For overhead work and close places this tool is invaluable, and is designed to save time and many a bruised finger. The price of these tools is $2, and should form a useful adjunct to the kit of every lineman and electrical mechanician.

The Johns-Pratt Company, of Hartford, Conn., are now prepared to push their Vulcabeston specialties for insulating material for electrical purposes. Vulcabeston can be molded into any desired shape, and can also be supplied in sheets from .02 of an inch to 1¼ inches in thickness. It is claimed that this insulation will not shrink, swell or absorb moisture, is acid proof, and is well suited for parts of dynamos and motors, as it is not affected by heat, containing as it does a large amount of asbestos. Such an insulation should be useful for lamp sockets, washers, and indeed in any place where high insulation is required combined with strength, fireproofness, and mechanical strength sufficient to stand any necessary machining. The Johns-Pratt Company are now running day and night, and are having a great demand for their goods both for electrical and steam purposes.

Mr. Charles H. Herrick, the popular secretary of the Wright Electrical Engineering Company, of Boston, has been the recipient of many congratulations from his friends on the occasion of his marriage to Miss Ida S. Snow, daughter of Dr. Snow, of Newburyport, Mass. The ceremony was performed at the home of the bride, and the staff of the Wright Company turned out to a man to do honor to Mr. and Mrs. Herrick. After the ceremony Mr. and Mrs. Herrick received their friends until eight o'clock, and left at 8.15 for a short wedding tour, after which they will be at home in Winchester, in this State. Among the many valuable presents received by the newly-married couple were a handsome silver service given by the members of the Wright Electrical Engineering Company, and a beautiful water-color picture from Pettingell, Andrews & Co., of Boston.

The Thomson-Houston Electric Company reports the following sales of arc and incandescent apparatus for isolated plants: Arc—Maryland Pavement Company, Baltimore, Md., 9; Alliance Street Railway Company, Alliance, O., 50; Philadelphia & Reading Coal and Iron Company, Pottsville, Pa., 30; St. Paul Foundry Company, St. Paul, Minn., 9. Incandescent—Mayfield Woolen Mills, Mayfield, Ky., 200; Western Kentucky Lunatic Asylum, Hopkinsville, Ky., 300; W. Russell & Co., Bellows Falls, Vt., 50; L. C. Bass Manufacturing Company, Guilford, Me., 100; Portland Steam Packet Company, Portland, Me, 400; Wayside Knitting Company, Troy, N. Y., 200; Carrollton Furniture Company, Carrollton, Ky., 150; Morgan Envelope Company, Springfield, Mass., 100; Cambridge Training School, Cambridge, Mass., 200; American Net and Wire Company, Cambridge, Mass., 200.

Electric Mutual Insurance Company.—Since the issuing of the prospectus of this company, which was fully discussed in The Electrical World of Feb. 1, it is interesting to note that a great many responses have been received from the managers or treasurers of electric light companies, assuring them of assistance and willingness to insure in this company. The prospectus has been brought to the notice of Mr. Edward Atkinson, president of the "Factory Mutuals," who said that "he is thoroughly convinced not only of the necessity for such a company, but of its success in business, and that he believes the growth of the electric light and power business to be such that there is no question but that there is business enough for the company from the outset." Over $300,000 insurance has already been pledged in response to proof copies of the prospectus submitted before it was made public. Copies of the prospectus can be had by applying to Mr. S. E. Barton, 85 Water street, Boston, or to Captain Brophy, of the New England Insurance Exchange, 59 Kilby street.

The Boston Manufacturers' Mutual Fire Insurance Company has adopted a set of rules for the protection of property insured by the company from fire caused by electric wires. Foreign electric wires may not be attached to buildings. Wires required in a building must enter it near the station of the night watchman, and be guarded by lightning arresters and protectors against strong currents. These protectors must be safely and accessibly located near the point of entrance of the wires, and without ground connection. Lightning arresters are to be placed between the protectors and the electrical apparatus within the building. Ground wires for the lightning arresters must not be attached to gas pipes. Waterproof insulation is demanded, and no wire may enter at a distance of less than three inches from another wire or conducting material. Wires carrying high tension or strong currents must be so strung that, if a break should occur, contact with other wires shall be impossible. High and low tension wires in the same yard must be kept so far apart that no contact or cross arc can be made.

The Johnston Electric Train Signal.—An interesting and successful trial of this useful device was made in the Revere Beach & Lynn Railroad this week, at which a large number of gentlemen interested were present. The system as seen consisted of a cord stretched along the ceiling of each car in which was inclosed two insulated wires, each of these made up of a number of finer ones. These wires connected with a storage battery placed in the cab of the engine, and were thence attached to an electric gong located near the engineer. The connection between the cars was made by an insulated rubber joint, each part of which fitted into the other in a dovetail fashion, the points of contact being made by the uniting of two metallic points made of bronze metal. At regular intervals the cord or cable was tapped and push buttons applied; these spanned the wire, and when the buttons, which were incased in rubber, were pressed the contact was made and the gong rung in the engine as often as the pressure was made, the engineer responding to whatever signal was given by the conductor, according to the regular code as adopted by the roads.

The Massachusetts Legislature have had several important petitions presented this week. Protection from electric wires was the subject of an order by Mr. Means, of Boston, as to making owners of electric wires responsible for all injuries to persons or property by said wires which are not caused solely by the negligence of the party injured, and requiring all owners of such wires to plainly mark or tag them at short distances. The Edison Electric Illuminating Company, of Boston, petitioned for authority to increase its capital stock to $2,000,000. A petition was also received from William B. Mack and others for incorporation, with the right to build, equip, maintain and operate an elevated railroad on the Mack system, to run over such locations, within a circuit of 10 miles from the State House, as may be granted by the board of aldermen and selectmen, respectively, of the cities and towns in which location is asked. The petition was tabled, on motion of Mr. Cook, of Bristol. The petitions for all the electric railroad charters have been taken from the table, referred and sent to the House for concurrence. If the House agrees to this reference, the elevated flight will come on at once, but if the House does not agree and tables them, it will take a two-thirds vote to refer them, under the amended rules.

F. W. Prescott & Co., bankers and brokers, who do a large and successful business in electric stocks as a specialty, have just taken possession of their new quarters, at the same address, 54 Devonshire street, Boston. On the occasion of their formal opening last Monday they had a large gathering of their friends, and served an elegant and recherché lunch from 12 to 2 o'clock, which was amply discussed and enjoyed. They have now a large and comfortable stock room, with a board showing the fluctuations of the New York and Boston Stock Exchange, and a special board with all the various electric stocks displayed thereon. At one end of this room is the cashier's department, with private lines to New York and Boston, stock tickers, etc., and entrance to the private rooms of Mr. Prescott, who looks personally after the interests of his numerous clients. At the other end is a very handsomely fitted retiring and lounging room for visitors, and there are other rooms for specialties, and for the Eastern Electric Cable Company, in which this firm are specially interested. The Eastern Electric Cable Company are enjoying an unprecedented success, and their stock is considered a valuable "buy." Besides this stock, F. W. Prescott & Co. handle the stock of the Electric Piano Company and the Gethins Improved Battery Company, both of which are achieving great success. The electric piano is attracting great attention from all over the country, and the demand for its stock is quite lively, owing to the large number of business orders received for its electrical attachments. The success of the Gethins battery is undoubted, and it is rapidly becoming one of the most popular of batteries for telegraphing, signaling and all kinds of closed circuit work. Orders for these batteries are being received every day, and all purchasers express themselves as more than pleased with its success. A visit to Messrs. Prescott & Co.'s quarters should be well worth making to all seeking to invest money in safe electrical securities.

Mr. Alex. P. Wright, whose friends in Boston were beginning to be a little alarmed at his sickness in New York City, were overjoyed to see him walk into the rooms of the Electric Club last Saturday night looking about as well as usual. Mr. Wright is so familiar a figure in electrical circles in Boston now that he is much missed on his occasional visits to other cities, and he is now evolving a very interesting programme of events for the coming session of the Electric Club, which I give in full:

PROGRAMME.

Monday, Feb. 3—Regular club meeting.

Monday, Feb. 17—Club dinner at which Mr. Arthur Lord will read a paper on "Legislation," relating to the transmission of "Intelligence, Light and Power by Electricity."

Monday, Feb. 24—Discussion on Mr. Lord's paper.

Monday, March 3—Regular club meeting.

Monday, March 10—Club dinner, address to be announced.

Monday, March 24—Paper by Mr. W. J. Denver on "Induction and Interference with Telephone Service from Electric Light and Power Circuits from a Telephonic Point of View."

Monday, April 7—Regular club meeting.

Monday, April 14—Club dinner, address to be announced.

Monday, April 28—Paper by Geo. W. Mansfield on "Single and Double Trolleys for Electric Railroads."

Monday, May 5—Regular club meeting.

Monday, May 12—Club dinner, at which Mr. S. E. Barton will read a paper on "The Relations between Fire Insurance and Electric Interests from the Underwriters' Standpoint."

MEMORANDUM—The House and Entertainment Committee, with the assistance of Messrs. Brophy, Hanson and Dumoulin, are preparing a series of questions to be submitted to practical electricians, and will prepare a report upon the answers received to same which will be read at meeting to be announced. A. C. S.

PHILADELPHIA NOTES.

Branch Office of The Electrical World,
31 City Trust Building. Philadelphia, Feb. 1, 1890.

Mr. H. G. Smiley, of Chicago, has been partaking of the hospitality of his Philadelphia electrical friends during the past week.

Mr. Wm. H. Francis, member of the Boston firm of Paine & Francis, agents for the Edison Company, was in this city last week.

Mr. H. C. Whitney, a representative of the Crosby Electric Company, New York, manufacturers of the Crosby dry battery, spent a few days during the week in this city.

Messrs. H. M. Sciple & Co., of Philadelphia, Pa., agents of the Ball Engine Company, have just installed two engines of that make at Huntingdon, Pa. Mr. B. M. Africa is using them in his electric plant.

Bronze Metal Push Buttons of new design and very pretty pattern are manufactured in various sizes by the Geo. H. Pierce Company of this city. This company's new catalogue will be ready for the trade about the middle of February.

Mr. Geo. F. Porter, general manager of transportation for the National Electric Light Association, has completed arrangements for the comfort of the New York and Philadelphia party, respectively, between the points named and Kansas City. Mr. Porter's address is care of the Westinghouse Electric Company, Girard Building, Philadelphia.

The Spellier Electric Time Company, of this city has arranged with the Holtzer-Cabot Electric Company, of Boston, to accept the New England agency for the Spellier system of electric time distribution. The Spellier Company is rapidly filling up the circuits already constructed in Philadelphia, and has several new sub-stations under advisement.

The Patent "Lift-Over" Burner, manufactured at the Cleverly Electrical Works, this city, is meeting with a large sale and giving thorough satisfaction. This novel, neat and durable device in electric gas lighting apparatus has already acquired a wide-spread popularity. It is very simple in construction and is an adornment to any gas fixture.

An Isolated Plant has been installed at the establishment of Messrs. King, Satterlee & Co., this city, by Lovegrove & Co., the well-known engine and boiler house, also of Philadelphia. The equipment of the plant includes a United States machine of 150 incandescent lights capacity, a Lovegrove tubular boiler of 40 h. p. and a "Valley" engine of 30 h. p.

Mr. H. T. Paiste, of this city, manufacturer of the switches cut-outs, and gas attachments bearing his name, is now nicely settled in his new factory at the northwest corner of Twelfth and Market streets. The enlarged manufacturing facilities now afforded will enable Mr. Paiste to promptly fill orders, and to enter into the manufacture of several new specialties.

Sprague Motors.—The equitable Electric Railway and Construction Company, of this city, contractors for Sprague Electric Railways, report the following: "Our company are wiring and equipping two street cars for an electric railway in Japan; and we have an order from the Pennsylvania Railroad Company to equip an eight-wheel car which that crrporation is now building for use next summer on their Atlantic City Electric Railway."

The Thackara Manufacturing Company, of this city, will have its salesrooms at the new building, Nos. 1524 and 1526 Chestnut street, completely fitted up, and ready to throw open to the public, by the time this item is read. The salesrooms occupy the entire lower floor, and part of the second floor, of the company's

magnificent new building. The counting-room and offices are located at the front of the second floor, and the factory takes up the immense space afforded by the three upper floors.

James J. Murray & Co., glass manufacturers, Trenton avenue, Culvert and Waterloo streets, this city, find business quite active in all lines of arc globes and incandescent shades, of which they make a large variety. Their specialities of glassware are quite popular with the electric light trade throughout this country, Canada and Australia. They are constantly getting up new shapes and designs of electric light globes and incandescent shades, and their capacity is so large that prompt shipment on receipt of orders can always be made.

Thos. H. McCollin & Co., of Philadelphia, are introducing in this country a lens well known in Europe, and which is destined to have a large sale among machinists. This is patterned after the well-known "Portable Symmetrical" of Ross, but is less than one-half in price. These can be used with full opening where a moderate size field is to be covered; while with a small stop they cover an angle of about 90 degrees. They are very rapid, and possess marvelous depth of focus, and the only wonder is how so good a lens can be produced so cheaply.

The Chester Foundry and Machine Company, at Chester, Pa., is building, it is said, the largest testing machine in the world for the Phoenix Iron Works Company, of Phoenixville, Pa. It will be operated by hydraulic pressure, and will test specimens in compression or extensions with an alleged strain of 2,160,000 pounds. The cylinder is a steel casting weighing 21 tons and is a magnificent piece of workmanship. This company is favorably known throughout the electric lighting field as manufacturers of the Brotherhood steam engine. Manager Jenkins reports that it is running full time in the various departments, particularly in castings for dynamos, special machine work and friction clutches.

W. I. B.

WESTERN NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
39 Mallers Building, Chicago, Feb. 1, 1890.

The Alamoso, Col., electric light plant will be in operation next week.

President J. A. Rhomberg, of the Dubuque Street Railroad Company, is stopping at the Grand Pacific.

Lyle & Lee, of Dowagiac, Mich., have just started their electric plant. The Ball Engine Company furnish the engine.

Mr. W. T. Griffiths, of Davenport, Iowa, is visiting Chicago and looking up the question of electric motor power.

Shay, Stephens & Co., Chicago, are sending out a very neat combined card case and memorandum book to the trade.

Mr. J. Potter, treasurer of the Brush Electric Company, Cleveland, has been stopping in St. Louis during the week.

Mr. W. R. Moore, president of the Moline, Ill., Central Street Railway Company, was a visitor in Chicago during the week.

Mr. J. H. McGraw, publisher of the *Street Railway Journal*, New York, was a welcome visitor in Chicago during the week.

Mr. John S. Pugh, of Baltimore, has been traveling over the Western circuit and interviewing all the prominent street car men.

Mr. D. W. Pugh, of the John Stephenson Company, New York, was comfortably quartered at the Southern, in St. Louis, last week.

Mr. John Kilgore succeeds Geo. B. Kerper as president of the Mt. Adams & Eden Park Inclined Railroad Company, Cincinnati.

Prof. Sidney H. Short, of the Short Electric Railway Company, of Cleveland, is visiting Chicago this week, en route home from St. Louis.

The Marinette, Wis., Street Railway Company has been incorporated by H. C. Higgins, Thomas Gaffney, Philip Gaffney, Edward Schofield and J. F. Hancock.

Mr. W. L. Ferguson, treasurer and general manager of the Citizens' Street Railway Company of Decatur, Ill., attended the association meeting at the Grand Pacific.

The Central Electric Company, Chicago, have received an unusual number of requests for the handsome calendar they have issued, owing to its many attractive features.

The American Gas Engine Company has been formed at Chicago, to deal in gas engines; capital stock, $200,000; incorporators, Charles Fellows, C. W. Annabin and H. C. Johnson.

Mr. Frank A. Rogers, representing the Short Electric Railway Company, of Cleveland, was present, making friends at the meeting of the electric street railway men at the Grand Pacific.

Hon. John S. Wise, of New York, stopped over in Chicago en route from Eau Claire, Wis., where he filed the answer of the railway company in the suit brought by the telephone company.

Mr. O. J. Chipman, representing some Des Moines, Ia., capitalists, has secured an option on the purchase of the Keokuk Street Railway, the intention being to convert it into an electrical road.

The Rotary Magnetic Ore-Separator Company has been formed at Chicago, to do a general mining business, etc.; capital stock, $500,000; incorporators, J. E. Smith, H. W. Smith and G. S. Finney.

The Elgin Electro-Hydraulic Company has been formed at Elgin, Ill., to furnish power and light by motor system; capital stock, $250,000; incorporators, R. E. Gray, W. H. Wilcox and W. A. Shephard.

Bushnell, Ill.—The Bushnell Electric Light and Power Company has been formed to furnish light, heat and power; capital stock, $5,000; incorporators, C. H. Cline, G. A. Kaiser and I. B. Cummings.

The Chicago Central Phonograph Company has been formed at Chicago, to manufacture, own, and deal in phonographs, etc.; capital stock, $200,000; incorporators, N. B. Judah, Fred G. O'Connell and A. A. Bliss.

The Chicago Edison Company will proceed at once to erect a new station in Chicago, and furnish current to parties desiring same residing between Sixteenth and Thirty-fifth streets, if sufficient encouragement is received.

The Wayne County Electrical Company, of Detroit, Mich., with a capital stock of $10,000, has been incorporated by Charles M. Smith, Edward D. Steff and Thomas Hislop, for the manufacture of electrical apparatus.

The Old Story.—The Huntington & Broad Top Railway shops at Saxton were destroyed by fire last week, following the explosion of an oil lamp. Loss $100,000. Moral: Use the only genuine and well insulated brand of electric lighting and save expense of rebuilding.

Julius Andrae, Milwaukee, has secured the contract for the installation of a 600-light Mather incandescent plant in the Val. Blatz Brewery, the dynamo to be driven by a Payne engine. The wiring is now being done, and the plant when finished will be one of the most complete in the country.

The Evanston Electric Illuminating Company, of Evanston, Ill., propose to turn the current on their eighty street lamps of the Waterhouse system for the first time on Monday evening, in honor of the arrival in Chicago of the delegates to the National Electric Light Convention.

The Northwestern Electric Construction and Supply Company, of St. Paul, Minn., report having recently closed contracts with the street railway companies in Portland, Ore.; Port-Townsend, Wash., and Superior, Wis., as well as with the St. Paul & Minneapolis Street Railway Company for the entire equipment of their line with the Thomson-Houston system.

St. Ignace, Mich., may have an electric fire alarm system. The Water Board is figuring on the expense of putting one in, and has already received a number of propositions. A Detroit concern offers to put in a twelve-box system for $600, and the local telephone company claims to be in position to do it for less money than that.—*St. Ignace (Mich.) News.*

Tiffin, O.—At the annual meeting of the Edison Electric Light Company, Tiffin, the following officers were elected: President, J. F. Bunn; vice-president, J. M. Naylor; secretary, C. J. Yingling; treasurer, W. P. Noble. Directors, J. F. Bunn, J. M. Naylor, C. J. Yingling, W. P. Noble, E. B. Hubbard, Hiram W. Yeager and J. M. Greiner. There is some talk of extending the plant.

Western Union Beaten Again.—At Boston, on Jan. 29, in the United States Circuit Court, Judge Colt rendered a rescript in the case of the Attorney General of Massachusetts against the Western Union Telegraph Company, being a claim of the State for the payment of taxes disputed by the company. On the basis of the rescript the taxes for 1886, 1887 and 1888 are to be collected.

The Knapp Electrical Works, Chicago, have received a heavy shipment of the smaller sizes of Grimshaw white core wires thus enabling them to fill all orders promptly. Their sales of Perkins lamps have been steadily increasing, especially since they have been carrying such an extensive stock of the various sizes, and now run up to an average of nearly 500 per day.

Fuse Wire.—The value of correct data concerning the exact temperature at which fuse wire melts, is shown in the application of the superintendents of electric light plants in all parts of the world for a copy of the dainty little table issued by the Electrical Supply Company, Chicago, and when the supply of circulars was exhausted, in having recourse to the issue of THE ELECTRICAL WORLD containing the table of temperatures, etc.

Electric Light at St. Charles, Mo.—An election was held in St. Charles last Tuesday upon a proposition to increase the city debt $150,000, for the purpose of establishing an electric light plant, to be run by the city. The proposition was opposed by the St. Charles Gaslight Company, but carried, nevertheless, by a majority of about five votes to one. The election was conducted under the Australian ballot system, which proved eminently satisfactory at the first trial.

Excellent Workmanship.—A good illustration of the superior quality of the material employed in the construction of electric machinery, as well as the high grade of workmanship, was shown, a few evenings since, when a person standing by the side of a No. 20 Edison dynamo of 50,000 watts capacity, moved the revolving armature from end to end, or sideways, with the slight pressure exerted on an ordinary brass pin, so true and perfect were the bearings.

Dr. W. L. Allen, of Davenport, Ia., in speaking of his electric railway at Stillwater, Minn., recently said that the system had given good satisfaction even in bad weather, and that little or no trouble was experienced in managing the cars on the long grade of 9 per cent., followed by a sharp curve rounding one block, then by a grade of 9¾ per cent., a curve and a grade of 5 per cent. to the bottom of the hill. Surely the opponents of electricity could scarcely desire a more severe test than is daily shown in Stillwater.

M. C. Chase has been engaged for the last eight years in the manufacture to order of all kinds of hard rubber goods for all electrical and mechanical purposes, making a leading specialty of hard rubber battery cells. In these products he has secured a deservedly high reputation and a trade which extends to all parts of the Union, earned by the uniform merit of his products. In addition to this large business thus built up Mr. Chase has recently become the general agent at Chicago for Gault's Artificial Limb Company.

Shield Brand Wire.—The delegates to the convention at Kansas City will find many excellent illustrations of the value of this special make of insulation for concealed work, as some of the finest buildings in that city are wired throughout with "Shield Brand," as, for instance, the W. B. Grimes six-story building, the Builders' and Traders' Exchange, and the Ford & Walsh building. In the cases mentioned, the work was done by the Kansas City Electrical Works, who are also installing a 400-light Mather dynamo in the Thorne building, which they are also wiring with "Shield Brand."

The Bishop Gutta Percha Company.—Mr. Ernest Hoefer, their Chicago representative, reports the sale of their double coated white core wires as steadily increasing, being especially in demand where the highest grade of incandescent wiring is required. The insulating material being applied by hydraulic pressure, without seam, makes a perfectly homogeneous and firmly adhesive insulation that can only be removed from the copper by sharp scraping. This feature prevents all possibility of moisture working its way in between the conductor and its covering, and thus renders it invaluable for use in packing-houses, mines and other places where there is constant dampness.

Telephone Quotations.—Col. S. G. Lynch, broker, 146 La Salle street, Chicago, furnishes quotations on telephone stocks as follows:

Chicago	$290@$295	Cumberland	$ 58@ $60
Central Union	58@ 59	Wisconsin	115@ 117
Michigan	97@ 99	Bell of Missouri	140@ 145
Great Southern	30@ 32	Iowa Union	25@ 28
Colorado	38@ 40	Missouri and Kansas	50@ 55
Rocky Mountain Bell	40@ 45		

ELECTRIC LIGHT STOCKS.

Chicago Arc Light and Power	$81@$82	Chicago Edison Co	$104@$108

Mr. W. H. Stead, treasurer of the City Electric Railway Company Ottawa, Ill., in referring to the franchise secured by his company, on the 23d inst., granting permission to build an electric railway in the city of Lasalle, said: "It is our intention to build nine miles of track within the cities of Peru and Lasalle and connect the two with a double line of track. The combined population exceeds 20,000. We shall commence work at the earliest possible moment, and while we have not fully decided on which system to use, we shall install only the best and latest improvements that have proven successful in practical operation. Steam power will be used for driving the generators."

The Pumpelly Storage Battery and Electric Motor Company, Chicago, are using a cellulose fibre as a packing material between the plates, and securing excellent results therefrom. This cellulose is made from wood pulp by a patented process, and used by paper manufacturers to mix with the rag pulp, in the making of the finest quality of white paper. It is perfectly inert, and unchangeable in any acid; also a non-conductor, thus adding no more to the conductivity between the pole plates of the battery than is given to the electrolyte by the use of a certain per cent. of sulphuric acid. It prevents all splashing in the cell, checks evaporation for a long time, retains the specific gravity of the electrolyte even throughout the entire cell, and does not, as one would suppose, increase the internal resistance. These advantages are marked when used for traction work.

The Death of the Old, the Birth of the New.—The Business Men's Club, of Evanston, Ill., with a keen sense of the humorous, propose to have a little scene at their ball next week that will not appear on the programme. As the guests fall in line for the opening march, at a signal from the president, the orchestra commences playing from the "Dead March in Saul," and, as the sad notes are wailing forth, the supply of gas, with which the hall is now lighted, will be shut off till all is darkness. Suddenly the music changes to a jubilant march, and the room is flooded with the soft light radiating from 300 16 c. p. Westinghouse lamps placed in clusters of six each, with a 50 c. p. Westinghouse lamp in the centre of each cluster, all being suspended from the ceiling. The effect can be imagined. The installation was made by Mr. Thomas G. Grier.

Dr. Louis Bell, of Chicago, has returned from Dubuque, Ia., where he witnessed the opening of the Key City Electric Railway, that has just been completed and the operation of which is delighting the citizens, who have long desired a perfect system of rapid transit. On Sunday last a No. 6 Sprague motor car, having two 15 h. p. motors, carrying 37 passengers and drawing a trail car with 65 passengers on board—all full-fare patrons—made the trip easily on the long two-mile climb without the slightest trace of heating. The grades cover 1,000 feet at 8 per cent., 400 feet 9 per cent., 1,200 feet 7 per cent., 1,000 feet 5 per cent., 900 feet 6 per cent., and the remainder 3 and 4 per cent. grades. On one trip, when the cars were heavily loaded, a 100 ampère fuse burnt out when the car was in the centre of the heaviest grade on the up trip, but a new fuse was placed in position and the train started again without the slightest difficulty.

Evanston Electric Illuminating Company, of Evanston, Ill., which is practically a suburb of Chicago, being but thirty minutes' ride distant, has its new station and plant nearly ready for operation. The building is of brick, two stories high, 50 feet wide and 78 feet deep. The steam plant, as at present installed, consists of two Heine boilers, of 75 h. p. each, with Rouey stokers, and one 65 h. p. and two 50 h. p. Westinghouse automatic engines. The electrical plant now consists of four 35 arc light dynamos of the Waterhouse system and one 750-light Westinghouse alternating current incandescent dynamo, but the capacity of the station will shortly be increased to 3,000 incandescent and 210 arc lights. From the incandescent dynamos the circuits lead to a Spencer switchboard, while the arc lights are controlled from a Westinghouse-Cook switchboard. The line circuits extend over a total of 27 miles on 35 to 45 foot poles, while one pole placed in the centre of the town is 75 feet in height and supports four lamps. The entire work from foundation to wiring has been done under the personal supervision of Thomas G. Grier, superintendent of construction for the Frank S. Marr Company.

Mr. W. M. Talcott, manager of the Western Light and Power Company, Chicago, is credited with the following statements appearing in a local paper:—The Western Light and Power Company, after some delay in the negotiations for the purchase of the electric lighting plant formerly owned and operated by the defunct Lake View Electric Light Company, have completed the purchase of the property, including all machinery, lines, franchises and rights of the old corporation and have commenced the active work of preparing the station and lines for an early operation of the same, under their new franchise granted by the city of Lake View shortly before annexation. They now expect to be able to furnish light and power by Feb. 1. A large number of arc lights have already been contracted for. Overhead wiring is now done in a style to prevent the least possible objection to its use. It would be impossible to put down underground wiring in the large territory covered by Lake View and the distance to be traversed to each consumer, even if a successful underground system were known, but as the manager of one of the largest electric lighting companies in Chicago, if not in the United States, said recently: I notice a statement in a morning paper to the effect that not one of the old lighting companies in Chicago would go back to pole lines if they could. I will say this: If the city of Chicago will allow us to erect pole lines and operate our light from them, we will make the city of Chicago a present of all our underground wires and conduits, costing us thousands of dollars.

Topeka, Kan.—A dispatch from Topeka of Jan. 26 says: "It was learned to-day that late yesterday application was made in the United States Circuit Court by the Thomson-Houston Electric Company, of Boston, for the appointment of a receiver of the Topeka Rapid Transit Railway, and for the foreclosure of a mortage on that road. The Electric Company built about 20 miles of electric road for the Rapid Transit Company, the cost being $186,000, which was payable in bonds secured by mortgage. By arrangement with the Metropolitan Trust Company, approved by the Thomson-Houston Company, first mortgage bonds in the sum of $600,000 were issued by the railway, and a trust deed of the property as security was issued. Under this arrangement bonds in the sum of $342,000 were issued in October, 1889. The Thomson-Houston Company accepted $100,000 of these bonds, and it claims a balance of $86,000. It claims that the railway company has these bonds, and should deliver them. It asks for the immediate delivery of the bonds, and in case of default that the railway be sold or placed in a receiver's hands. The Metropolitan Trust Company of New York is made a party to the suit. The Rapid Transit Company will oppose the application for a receiver. "The Rapid Transit Company has the $86,000 bonds claimed by the Thomson-Houston Company," it says, "and proposes to keep them until the Thomson-Houston Company complies with its contracts with us. Under our contract with the Thomson-Houston Company, the bonds were not to be delivered until the equipment was furnished, and the plans completed and occupied by this company. The plans have not been carried out nor the terms of the agreement. They agreed to furnish us with a guarantee protecting us in the use of the patents used by them, and to furnish us with a bond guaranteeing to furnish us with all electrical improvements at a reasonable price, and without royalty charges. That guarantee they have not so far kept."

F. DE L.

WATERTOWN, WIS., Jan. 16, 1890.

The Watertown Electric Light Company's Plant.—Among the many electric light installations few, if any, surpass in general excellence the combination plant of the above-named company. The power house is a brick structure 50x90 feet, with a chimney of splendid proportions, rising to the height of 90 feet above the ground, and is situated on the east bank of Rock River, in the centre of the city. It is divided into two sections by a heavy brick wall. The rear portion of 40 feet, thus formed, constituting

the boiler room, in which is placed a battery of two steel boilers, each of 75 h. p. capacity, made by the Miller & Reichard Manufacturing Company of this city. These boilers are perfect in every particular, standing the highest hydrostatic test, and reflect great credit upon their makers. The engine and dynamo room is a model of its kind. The engine is of the Corliss type, made by the Weisel & Vilter Manufacturing Company, of Milwaukee, Wis., and is in every respect a perfect piece of mechanism. It rests upon a bed as solid as it is possible for nature and art to make it, being composed of concrete, capped with the finest quality of brick laid in cement, which in turn is mounted with heavy blocks of limestone, and the whole massive structure resting upon the bed rock 12 feet below the surface. It is not surprising, after what has been stated, that this powerful engine of 142 indicated horse power manifests no perceptible tremor anywhere in its most immediate neighborhood. In connection with the engine a Berryman feed water heater and Knowles pump are doing good work, and are giving excellent satisfaction. The lighting plant was furnished by the Thomson-Houston Electric Company, and consists of one arc generator of 50-light capacity, and one alternating machine of 650 lights, respectively, furnished with the usual complement of regulating and indicating apparatus. The dynamos are run from shafting, the pulleys of which are furnished with Hill friction clutches. The plant was contracted for last July. Work was immediately begun upon the power house, under the supervision of the able master mechanic, F. W. Ghores, who mounted the engine and did not leave his post until the arc lights were turned on, Dec. 2, 1889.

The electrical work was done under the supervision of the Thomson-Houston Company's expert, Mr Geo. Morine, and the entire work, from the setting of the first pole to the placing of the lamps in their sockets, is alike a credit to himself, his assistants and his company. The success of the local company has been most encouraging, nearly the entire capacity of the arc machine being already absorbed, and at the present writing wiring is fast being completed for over 450 lamps. The indications are that it will not be long before the capacity of the incandescent machine will be taken up also. The engine and dynamos are operated by Aug. Hansen.

St. Louis, Mo., Jan. 28, 1890.

Mr. James P. Fowden, of St. Louis, is now representing the Parker-Russell company in the local trade.

Mr. Charles J. Van Depoele, the electric railway genius, made a flying business trip to St. Louis this last week, and stopped over in Chicago on the return trip east.

The Commercial Electric Company, Detroit, report heavy sales of Sawyer-Man incandescent lamps, and of their patented "wire guard," designed to protect any incandescent lamp.

Mr. Edmond Verstraete, formerly with the Van Depoele Electric Company, Chicago, is now in charge of the electrical department of the St. Louis Car Company's works on Broadway, St. Louis.

The Shultz Belting Company, St. Louis, state that the demand for their new work on belting, etc., is unprecedented, and proves how great an interest electricians are taking in this important subject.

The Fidelity Carbon Company, St. Louis, has obtained the contracts for making the Mason battery carbon, the carbon for the Franklin dry battery being brought out in Chicago, and the carbon boxes 14x6x3½ inches for the McLaughlin battery.

Little Rock Fire-Alarm System.—The Board of Public Affairs have awarded the contract for the fire-alarm system. The complete outfit will cost the city $10,000. Work will commence immediately. The Gamewell system was adopted.

The St. Louis Car Company are about to place on the market a new form of Kling's independent truck for electric motor cars, in which the motor will be entirely shielded from damage by slush or wind, the rheostat also being protected in like manner.

The Fidelity Carbon Company, St. Louis, are supplying the United Edison Company with the cored carbons used in the Simplex arc lamps operated on the incandescent circuits. The company report business unusually good, large shipments being made to many points.

The Southern Electrical Supply Company of St. Louis have fitted up their new quarters at 823 Locust street in an attractive fashion, while arrangements have been perfected that facilitate the rapid shipment of orders. The growth of their business has been remarkable, and the prospects for the current year are unusually bright.

The Heisler Electric Light Company, St. Louis, have three 450-light, 32 candle power dynamos in operation in the old station temporarily being used by the Laclede Gas Company that are supplying current through circuits aggregating a total of eighty miles of wire. Of course a far greater number of lights will be operated on these circuits as soon as the new station is completed.

Looking for a Location.—Col. R. C. Clowry, of Chicago, vice-president of the Western Union Telegraph Company and general manager of the lines west of Pennsylvania, has been in St. Louis securing a building for the Western Union service. Overtures were made him by Mr. Robert J. Lucas for his building on the south side of Pine street, just west of the Planters' House.

Telephone Inspector.—The new office of Inspector of Telephones of the city of St. Louis attracts the attention of politicians. It is reported that the Mayor will give the place to Mr. Mortimer D. Shaw, an able telegrapher and electrician, and a great friend of Noonan's. Mr. Shaw is at present the representative of the United Press, and his only desire to get the office is to benefit his health, which has been ruined by night work.

The Union Electrical Construction Company, St. Louis, are doing a large amount of incandescent wiring, among the contracts lately finished being that of the Boatsmen's Bank, the German Savings' Bank, Hudson A. Bridger's handsome residence; also the residences of Gus Nieman, Charles Kunkel and William G. Lemps, the famous brewer. All these residences were wired for bells, burglar alarms, etc., in addition, and all the combination or electric fixtures were supplied by this company.

The Rose Electric Light Supply Company, St. Louis, have removed their office and warerooms to 1106 Pine street, where they have handsome and commodious quarters on the ground floor. The following is a list of recent sales, made by this company, of arc-light dynamos and lamps: Hall Safe and Lock Company, Cincinnati, Ohio, thirty-five 2,000 c. p., Indianapolis Jenney system; Effingham Electric Light and Power Company, Effingham, Ill., thirty-five 2,000 c. p., Indianapolis Jenney system; Electric Light and Coal Company, Belleville, Ill., twenty-three 2,000 c. p., Fuller-Wood or American system; Provo Electric Light Company, Provo, U. T., twenty 2,000 c. p., Fuller-Wood or American system; Ohio Falls Car Company, Jeffersonville, Ind., twenty 2,000 c. p., Fuller-Wood or American system; Woodward & Tiernan Printing Co., St. Louis, Mo., ten 2,000 c. p., Fuller-Wood or American system; South St. Louis Foundry, Carondelet, Mo., ten 2,000 c. p., Fuller-Wood or American system; Missouri Car and Foundry Company, St. Louis, Mo., sixteen 2,000 c. p., Fort Wayne Jenney system; Lapeer Electric Light Company, Lapeer, Mich., sixteen 2,000 c. p., Fort Wayne Jenney system; Big Sandy Packet Company, Cincinnati, Ohio, sixteen 2,000 c. p. Fort Wayne Jenney system; H. H. Wayland, Moberly, Mo., ten 2,000 c. p., United States system; Fidelity Carbon Works, St. Louis, Mo., ten 2,000 c. p., United States system; McDonald Rolling Mills, St. Louis, Mo., ten 2,000 c. p., United States system; C. S. Bell & Co., Hillsboro, O., five 2,000 c. p., Bain system. Incandescent dynamo: Electric Light and Coal Company, Belleville, Ill., one thousand 16 c. p. lamps capacity, Slattery system; Electric Light and Coal Company, Belleville, Ill., four hundred and fifty 16 c. p. lamps capacity, Edison system; St. Louis Electric Power Company, St. Louis, Mo., four hundred and fifty 16 c. p. lamps capacity, Edison system; Little & Becker Printing Company, St. Louis, Mo., sixty 16 c. p. lamps capacity, Thomas system; Heim Brewing Company, East St. Louis, Ill., forty 16 c. p. lamps capacity, Kimball & Davis system; the Distilled Water Ice Company, Cairo, Ill., fifteen 16 c. p. lamps capacity, United States system.

Cincinnati, O., Feb. 1.

The Thomson-Houston people are progressing very successfully. They are obtaining customers all over the city. They are at present running a dynamo at the Brush station. Their large station at Corn street and Broadway has not been completed yet, but they are pushing it for all that's out.

The First Cincinnati Edison Illuminating Company are about to move from their present place of business, Fourth and Vine streets, to Elm street. They will put in two new boilers made by the Abendroth & Root Mfg. Company; one New York Safety engine and two new dynamos. Their plant will then contain two New York Safety engines, two Armington & Sims engines and eight dynamos. Mr. S. I. Crane, chief engineer, is making the plans for the new station, which is expected to be running by May 1, 1890.

ENGLISH NOTES.

London, Jan. 15, 1890.

Electric Welding.—A strong syndicate has been formed in London to push the Thomson electric welding process in this country. Demonstrations of the simplicity and other advantages of the process are being given in the metropolis, and some plant is being put up at Birmingham for the same purpose.

The Brush Electrical Engineering Company.—The chairman and directors of the Brush Company celebrated the tenth anniversary of the company's formation on Monday last in a most unique manner. On the evening in question over 150 persons enjoyed the hospitality of Lord Thurlow and his colleagues in the magnificent Whitehall Room of the Hotel Métropole. The peculiarity of the entertainment lay in the fact that not only were eminent men of science and great financiers present at the feast, but the invitations were extended, as Sir Frederick Bramwell wittily expressed it, "in a spirit of Christian revenge," to their trade rivals and doughtiest opponents in the law courts. In fact, this dinner may be said to have been a formal intimation that for the Brush Company, at any rate, litigation is a thing of the past, and that henceforth it intends to devote its energies to the more profitable field of commercial enterprise, a field in which, as Lord Thurlow remarked, there was now room for every one. As was to be expected, the speeches were markedly sanguine as to the future, and the speakers, one and all, agreed that now the dead weight of communistic legislation had been lightened, English electrical engineers ought to make up for lost time, and endeavor to equal, if not surpass, the remarkable record of the United States. Conciliation and compromise are, of course, the natural attributes of after-dinner speeches; but at the same time there is at the present moment an undoubted disposition among electrical engineering firms in this country to bury the hatchet, and to unite in a vigorous assault upon the conservatism and vested interests which have so long obstructed electrical progress in England.

The Electric Lighting of St. Pancras.—The vestry of the Metropolitan district of St. Pancras, which has a population of over a third of a million have at last resolved to carry out the electric lighting powers conferred upon them by their Provisional Order of 1883. It is needless to say that, before arriving at this decision, the vestry went into the subject in the exhaustive manner usual to English local authorities. The Special Electric Lighting Committee of the vestry visited the chief central stations in the metropolis, and received no less than four lengthy and detailed reports on the subject of electric lighting from Prof. Henry Robinson, as well as a long historical review of the whole question from the vestry clerk, the final outcome being that, on Wednesday last, the vestry of St. Pancras decided, by 28 votes to 16, to obtain plans, specifications and tenders for the supply of electricity for the purposes of light and motive power, for 10,000 16 c. p. incandescent lights and 90 arcs. As this district is already applied for by several companies, and as the Board of Trade have given the Vestry plainly to understand that unless they, without further delay, undertake the lighting themselves these applications may be favorably considered, it may, I think, be anticipated that we shall before long see a municipal station at work in the metropolis. An interesting feature in connection with this installation will be the adoption of the continuous current transformer system. We have already at work in the metropolis at least half a dozen different methods of distribution, and it is strange that the continuous current transformer system, from which many electrical engineers anticipate so much, has not hitherto been one of those tried. The total cost of the scheme is estimated at between £50,000 and £60,000, and the vestry proposes to apply the seven per cent. profit, which is the maximum they are allowed to make by Parliament, to the relief of the Rates, by replacing 400 gas lamps by 90 arcs. The vestry of Paddington, which is in a similar position to that of St. Pancras, and which has received the usual quota of reports from eminent electricians, will no doubt be emboldened by this decision to take the final plunge, and ask for electric lighting tenders.

New Board of Trade Regulations.—Influenced no doubt by the panic which the daily press have endeavored to create, the Board of Trade have in a forward state of preparation a new series of regulations respecting the supply of current for lighting purposes. These regulations principally concern transformer companies. In previous regulations, systems of supply have been defined as high or low potential systems; with the Ferranti scheme in prospect, the Board of Trade now define a "low potential system" as that in which the pressure never exceeds 300 volts for continuous, or 150 volts for alternating currents; a "high potential system," as one in which the difference of potential does not exceed 3,000 volts an "*extra high potential system*," as one in which the pressure exceeds 3,000 volts. Some of the more important clauses of these regulations may perhaps be of interest to your readers. It is laid down that the maximum working current in any conductor is not to raise its temperature more than 30 degrees F. The insulation resistance of any high-pressure conductor is not to be permitted to fall below 50 megohms per mile. Where high-pressure supply is employed, the leakage of the current is not to exceed 1-25th of an ampère in the case of continuous currents, or 1-50th of an ampère in the case of alternating currents. Clause 14 is of special importance, in view of the method which the London Electric Supply Corporation proposes to employ in distributing current. This clause lays down that wherever sub-distributing stations are used they must be established on suitable premises in the *sole* occupation of the undertakers. Clauses 20 to 23 cannot fail to commend themselves to those who wish to see an end put to fires and other accidents caused by faulty indoor wiring. These clauses are to the effect that supply companies, if they have reason to think that there is a connection to earth on any consumer's premises, may cut off the current and inspect the indoor wiring, and if a fault *is* discovered they may without further ado call upon the consumer to put his fittings into proper order, and refuse to supply current until this is done. To prevent the companies from skirking their duty in this respect, the Board of Trade propose to inflict a penalty of £20 for every such default, this penalty not affecting the liability of the undertakers in respect of any damage which may be caused by reason of their not cutting off the current from a defective installation. The Board of Trade further lay down that the difference of potential at the mains is not to vary more than three per cent. from the standard pressure in the case of a general supply at low pressure, or more than two per cent. in the case of a general supply at high pressure. The variation of pressure at the terminals of the consumers' lamps is not to exceed four per cent. One important clause in these regulations is that the system of distributing mains must be so arranged that whenever it becomes necessary to stop the supply for a longer period than one hour, the amount of supply so stopped shall in no case exceed a maximum of 100,000 watts. Finally, there is a clause providing that when once the supply has commenced it is to be a practically constant supply, since the current is only to be cut off at intervals previously arranged between the supply companies and the local authority. It is to be understood that these regulations are not as yet issued, and as they have been submitted to experts and others interested, it is possible that in their final shape they may differ considerably from their present form.

THE TELEGRAPH.

Athens, Ga., is likely to put in an electric fire alarm system.

Brazilian Telegraphs.—A dispatch from Rio Janeiro report that a defalcation of 90,000 pesos has been discovered in the telegraph department, and that the chief, Baron de Caperema, has been arrested.

Short in His Accounts.—A dispatch from Washington of January 28 says; "Lieut. William D. Wright, lately in charge of the United States Sea Coast Telegraph line in New England, is missing, and his accounts are $300 short."

Taxes on Telegraph Property in Illinois.—Judge Tuley decided in Chicago, on Jan. 28, that the Postal Telegraph Company must pay the $5,400 tax levied on the capitalization and franchise of the Board of Trade Telegraph Company, whose lines are leased and operated by the Postal Company. The Postal will appeal to the Illinois Supreme Court on the ground against which Judge Tuley decided—that it is a foreign corporation and should be taxed only on tangible property.

THE ELECTRIC LIGHT.

Henderson, Ky., talks of a plant.

Crisfield, Md., will probably have a plant.

Dublin, Tex.—An electric light plant is proposed.

Opelika, Ala., is likely to have an electric light plant.

Alameda, Cal., has voted $25,000 for electric light bonds.

Davidson College, N. C.—It is proposed to put in a plant.

Ceredo, W. Va.—The J. H. Millender Lumber Company has put in a plant.

Washington, Ga.—The Excelsior Manufacturing Company will put in a plant.

Sallneville, O., proposes to issue bonds in the sum of $5,000 for an electric light plant.

The Waterhouse Electric Company, of Baltimore, Md. have just installed their fourth 100 h. p. Ball engine.

Elizabethtown, Ky.—H. A. Sommers is organizing a stock company to erect an electric light plant, ice factory, etc.

White Plains, N. Y.—The Gas and Electric Light Company is increasing its capital stock to $150,000 to meet extensions of plant.

Grafton, W. Va.—Mr. A. R. Campbell's company has secured a town contract, and will have its plant in operation in six months.

The Ball Engine Company has just installed a steam plant at Somerset, Ky., for the Central Thomson-Houston Electric Company of Cincinnati, Ohio.

Baton Rouge, La.—The Baton Rouge Electric Light and Power Company will increase its capital stock and spend a sum not to exceed $25,000 in improving its plant.

Antwerp, N. Y.—The Antwerp Electric Light Company has been formed by E. B. Buckley, J. D. Ellis, M. Augsburg, W. M. Johnson and M. H. Burt, with a capital stock of $12,000.

Mexico, N. Y.—At a town meeting in Mexico, N. Y., a five years' contract was made with the local lighting company for 25, arc lamps. The company is using the Schuyler system and is much pleased with it.

The Westinghouse Electric Company has shipped a 125-light arc dynamo, Westinghouse new arc light system, to New York City. The machine will run in connection with converters, and the flat carbon lamp will be used.

New Westinghouse Stations.—Two new central stations are now being installed with the Westinghouse alternating current system, one at Uxbridge, Mass., and the other at Gouverneur, N. Y. Each plant will have a capacity of 750 lights.

The LeGrande Edison Electric Company, of LeGrande, Ore., have received a 100 h. p. steam plant from the Ball Engine Company of Erie, Pa. This plant was put in by the Northwestern Electrical Supply and Construction Company, of Seattle, Wash.

Salem, Mass.—The Salem Electric Light Company held its annual meeting last Tuesday and re-elected the old board of officers. The financial showing was excellent, and there has been a large increase of business since the occupation of the new premises on Peabody street.

McKinney, Tex.—The McKinney Electric Light Company have ordered a 500-light Westinghouse incandescent machine, and will add it to their plant, which now comprises an Excelsior arc

machine. The installation will be gone ahead with at once, and lights turned on us quickly as possible.

Akron, O.—The city of Akron is now advertising for proposals for lighting for a term of three years. About 200 arc lights will be required, to be lighted all dark hours. Bids may be addressed to Newton Ford, city clerk, up to February 15. The city is getting information on the municipal plant question.

Lawrence, Mass.—The annual meeting of the Edison Electric Illuminating Company was held recently, and the old board of directors, consisting of F. E Clarke, George Russell, W. E. Parker, Joseph Shattuck, Herbert W. Field, Dr. J. H. Kidder and H. M. Whitney, was re elected. F. E. Clarke was elected president and H. M. Whitney clerk and treasurer.

Sacramento, Cal.—B. Steinman has instituted a suit in the Superior Court against the Central Electric Light Company, C. F. Fargo, R. Hamilton, Joseph D. Redding, L. L. Baker, H. G. Smith, Eugene J. Gregory, W. McLaughlin, and Henry C. Wolf, comprising the Board of Trustees, for a temporary injunction restraining the defendants from entering into contracts for lighting the city with electricity. Various improprieties are charged.

The Carnegie Library Building in Allegheny City, Pa., is to be lighted with the Westinghouse alternating current system. This is the grand edifice which was erected by Mr. Carnegie and presented to the citizens of Allegheny by him. The structure is composed of granite and its arraugements are very handsome throughout. The total cost was about half a million dollars. A plant of 900 incandescent lamps will be operated in the building. It is stated that President Harrison will open the library.

Mt. Vernon, O.—A singular accident happened at the Schuyler station at Mt. Vernon last week. Smoke was discovered coming up through the ground in the boiler-room, and on opening up around the boiler wall, it was found that a lot of railroad ties which had been used in filling in the lot were on fire, and as soon as the opening was made the whole foundation sank away, making a hole large enough to bury the building in. The fire had spread itself under nearly one-half of the entire station and was spreading rapidly when discovered. A large force of men was put to work taking out burning ties, putting in temporary piers to hold the boiler, and in fighting the fire. One night the city was entirely without light, and by the next night the energetic secretary of the company, Mr. P. B. Chase, had secured a locomotive from the C. A. & C. R. R., had run it up next to the station, had made connections and lights were running in good shape. After a stubborn fight, the fire was conquered and everything now is in good condition. The question as to where the responsibility and loss will be placed is now agitating the minds of the stockholders of the Mt. Vernon company.

Westinghouse Electric Company.—The new building at the works of the Westinghouse Electric Company was completed a few days ago, and the necessary machinery is now being installed. It will be ready for occupancy by Feb. 1. This is the structure which has been put up in place of the one burned in September last. The new factory is a six-story brick structure 60 by 100 feet, and its space will greatly add to the capacity of the works. The ground floor is to be used for the storage of dynamos, exciters and motors. On the second floor will be a drafting room, and the rear portion is to be set apart for the winding department of large converters. The third floor will be used entirely for the manufacture of converters, 100 winding lathes being put on this floor. On the fourth floor the manufacture of the flat carbon arc lamp will be carried on and 500 lamps is to be the weekly capacity. The fifth floor is set apart for the same purpose of arc lamp manufacture, while the sixth floor will be used as a storage space. This new building will form an addition to the works which the company, on account of its constantly increasing business, has been greatly needing.

Miss Garrett's Picture Gallery.—A special dispatch from Baltimore, Md., of Jan. 24, says: "The rich interior of the beautiful marble home of Miss Mary Garrett yesterday evening presented a unique scene of splendor, the occasion being the lighting of the house by an odd arrangement of electric lights. The motive of the lighting was to obtain a complete illumination by electricity of Miss Garret's gallery of sixty or seventy grand paintings by Rosa Bonheur and other celebrated artists, and to guard against the fading out of the pictures by the actinic properties of the electric light, which has an effect upon colors like sunlight. In the hallway, from which the stairway leads, lending a soft but powerful glow, was one chandelier of about 150 gas-lights in three tiers, which are ignited by electricity. The dome-shaped conservatory, filled with plants from the smallest size up to 20 feet, was lighted by a single light, so governed by shades as to produce a silvery moonlight. In the small room connecting with the art gallery an entirely different method is used whereby the light is thrown upon the pictures as in a cyclorama. It is in the art gallery where the most wonderful results are seen, although the arrangements are not entirely completed. At the touch of a key a full, softened light, from which every element of glare is absent, illumines the whole apartment, throwing the pictures into the strongest view. Several dozens of the lights are placed about 25 feet above the floor, and the rays are toned by thicknesses of ground glass, the electric current being furnished by a city company."

APPLICATIONS OF POWER.

Buena Vista, Ga., is likely to have an electric road.

Independence, Ia., has already raised $10,000 for an electric road.

New Augustine, Fla.—Mr. J. K. Rainey proposes an extension of the electric road.

Jackson, Tenn.—A local company will probably be formed to furnish electric power.

Green Cove Springs, Fla.—The new hotel company is to put in an electric railway, it is said.

Atlanta, Ga.—It is said that Mr. Joel Hunt proposes to erect a 3,000 h. p. plant to furnish electric power.

Wellsburg, W. Va.—The Wellsburg Electric Light, Heat and Power Company will put in an electric road.

The Mine and Mill Electric Equipment Company has been formed at Pittsburgh by W. A. Giles, J. S. Scully, J. W. Carnahan, W. J. Burns, J. V. Patton and F. W. McKee.

Port Townsend, Ore.—The Port Townsend Electric Street Railway, Light and Power Company has signed a contract for the equipment of three miles of road with the Thomson-Houston system. The cost is put at $100,000.

Augusta, Me.—A contract has been signed to furnish Augusta with an electric railroad using the Thomson-Houston system, which will be in operation to Hallowell by July. The road will in all probability be extended to Gardiner.

Lynn, Mass.—A special dispatch from Lynn of Jan. 29, says: "The Thomson-Houston Electric Company have received an order to equip 100 motor cars and 60 locomotives for the St. Paul & Minneapolis Street Railways. The cost will be over $2,000,000."

The Card Electric Motor and Dynamo Co. has been incorporated at Covington, Ky., by Robert J. Smith, Alexander Montgomery, Alfred Mack and T. F. Corry for the manufacture of electric motors, dynamos, regulators, etc. The capital stock is $200,000.

The Bentley-Knight Company.—A judgment for $101,484, in the suit brought by the Thomson-Houston Electric Company in the Supreme Court against the Bentley-Knight Electric Railway Company, on four promissory notes, was filed in the County Clerk's office on Jan. 28.

Lawrence, Mass., is agitated at present over the proposed electric railway between Lawrence and Methuen. It is reported that representatives from Boston have stated that the West End Street Railway Company have reduced the running cost by one-third on the roads using the electric system.

The Sprague Mining Locomotive.—We wish to note a correction to the description of the Storey electric locomotive published in our last issue. The apparatus is now manufactured from designs furnished by a number of engineers connected with the Sprague Company, and will be known by the name of the Sprague eighteen-inch gauge electric mining locomotive.

The Buffalo Street Railroad Company's Electric Road to Forest Park has done excellent service this winter. There are four cars at present, and they have run on time through all weathers. Not a single hitch has occurred since starting up last July. It is anticipated that the line will run through Forest avenue and Niagara street in the spring. Mr. F. S. Drake is superintendent, and Messrs. W. J. Saward and E. Price electrical engineers.

The Concord, N. H., Horse Railroad, who have voted to adopt electricity, have contracted with the Tripp Manufacturing Company, of Boston, for the celebrated Tripp anti-friction journal bearings, which will be furnished with trucks complete. These bearings are giving perfect success on various roads and are rapidly coming into general use. The severe tests given them has caused a vast amount of discussion, but their durability is no longer experimental.

The Jenney Electric Motor Company, of Indianapolis, Ind., was duly incorporated on the 17th ult., with a capital stock of $35,000, and succeeded to the business of Charles D. Jenney & Co. The incorporators are Addison Bybee, Julius F. Pratt, Chas. D. Jenney and Edwin W. Jenney. The company will carry on the manufacture and sale of electric motors and other electrical machinery at their present location, No. 224 South Illinois street, where the necessary machinery is being added for more than doubling their present capacity. Additional floor space has also been secured.

PERSONALS.

Prof. A. G. Bell was given a banquet at Omaha on Jan. 25 by the Nebraska Telephone Company.

Mr. C. D. Smith.—We regret to announce the death of Mr. Chas. D. Smith, secretary and treasurer of the Connecticut Motor Company.

Mr. Sidney Rowell read an interesting paper before the Albany, N. Y., Institute, on Jan. 21, on "Applied Electricity." It was mainly devoted to the advocacy of low tension direct current for light and power.

Mr. Lemuel W. Serrell, who is well known from the good work he has done in the electric motor field, has now opened an office at 115 Broadway as a consulting and constructing mechanical and electrical engineer.

Mr. S. S. Dickenson, who has charge of the Commercial Cable Company's large station at Canso, N. S., has been a recent visitor to New York, renewing many old acquaintanceships, and making plans for coming work.

Mr. C. M. McNett.—We regret very much to learn of the serious and continued illness of Mr. C. M. McNett, the Washington agent of the Thomson-Houston Electric Company. He was one of the pioneer agents in the service of that company, and perhaps has installed more electric lighting plants in Virginia, West Virginia, North Carolina and the District of Columbia than all the other companies combined. During the fall of 1888 Mr. McNett's health broke down, and his physicians advised him to spend the winter in Southern California. He did so and returned in the spring much worse, and has, we are sorry to say, not mended since.

Mr. J. R. McLaughlin.—The Detroit *Journal* of recent date says: "J. R. McLaughlin, who represents the Sprague motor interests in Detroit, was afforded a two-fold surprise at his home, 260 Hancock avenue, last evening. Mrs. McLaughlin was responsible for the arrival of a number of the friends of Mr. McLaughlin, to whom a luncheon was served. The social feature of the event was quite as pleasant as surprising to the host, but the chief surprise was afforded when under his napkin Mr. McLaughlin found an exquisite New Years' token in a watch charm representing in its most intricate details an electric motor fashioned in gold. The piece was manufactured by F. G. Smith, Sons & Co., and was an example of their cleverest workmanship."

Mr. W. H. Cull becomes the electrical superintendent of the Albany, N. Y., Railway Company. The local *Argus* says: "Mr. William H. Cull, the efficient assistant manager and electrical superintendent of the Hudson River Telephone Company, has resigned, and will soon enter upon a new field of duty as manager of the electrical equipment of the Albany Railway Company. Mr. Cull, for the past seven years, has been electrical superintendent and assistant manager, under Superintendent Uline, and prior to that time he was in charge of the fire-alarm service for a like period of seven years, and still earlier was connected with the American District Telegraph Company. In all of these positions, but especially in that he held with the Hudson River Telephone Company, he has shown marked ability. He is efficient in his chosen electrical path, and all who know him will be gratified at the promotion of an intelligent and courteous gentleman."

MISCELLANEOUS NOTES.

Aging Italian Wines.—It is stated that 50 kinds of Italian wine are now being treated with electricity, and that the results in aging, flavor, etc., are excellent.

The Berlin General Electrical Company purposes, in conjunction with the Aluminum Industries Company, to erect in Austria a large establishment for producing aluminum and its alloys, and it has secured for this purpose, at Lenal (Salzburg), a water power of several thousand horse power.

Electrical Execution.—Mr. Stein, of New York, has proposed in the State Legislature an amendment to the Electrical Execution bill, which compels the attendance of the agents and warden of the prison where the execution occurs, and upon three days' notice a justice of the Supreme Court, the district attorney, and the sheriff of the county in which the conviction took place, two physicians, twelve citizens and seven assistant deputy sheriffs. It also authorizes the holding of a post-mortem immediately after the execution and the destruction of the body by quicklime unless it is claimed by relatives or friends.

BUSINESS NOTICES.

Lava Insulation.—The D. M. Steward Manufacturing Company, of Chattanooga, Tenn., write: "Our orders for last week included one from the Thomson-Houston Electric Company, Lynn, Mass., for 200,000 pieces of our patent Lava Insulation."

The Okonite Company will be on hand at the convention, bright and early, as usual. They make a good wire, and are "hustlers." The demand for their goods is steadily increasing, and the indications point to an enormous volume of business during 1890.

Battery Cut-Out.—Attention is called to a simple device for disconnecting gas lighting batteries if accidentally grounded. It is cheap, sensitive, never needs watching, and has no clockwork to be kept wound. Terms furnished by the Electric Supply Company, of Syracuse, N. Y., No. 105 South Warren street.

The Litofuge Compound for boilers is being pushed more than ever, and the Litofuge Company, 53 Cedar street, will call upon steam users in any part of the country and make practical demonstration as to its efficacy in preserving boilers, removing scale, saving fuel and giving pure, live steam. This is a specialty that electric light men should put to trial in these days of low rates for lighting, when a dollar saved comes easier than a dollar earned.

Fishkill Landing Machine Company.—The enterprise and progressive spirit manifested by the Fishkill Landing Machine Company, located at Fishkill-on-the-Hudson, N. Y., cannot but redound to their great advantage. These wide-awake engine builders are always at the top of the heap, and the notable improvements made from time to time in their famous Fishkill-Corliss horizontal engines keep them there, and their specialty ever gaining in popularity. The company have recently brought out an improved pattern Fishkill-Corliss engine, specially well adapted for electric light plants.

The Kodak Camera.—One of the latest novelties—and a charming one it is—is the Kodak camera, brought out by the Eastman Dry Plate Company, of Rochester, N. Y. This consists of a small oblong box no longer than an ordinary cigar box. A roll of prepared paper stands behind the lens, which is covered by a revolving shutter. The box is presented to the object to be photographed; a little stud is pressed with the forefinger of the left hand—snap goes the shutter; the exposure has been made, and a turn of the handle on the top of the box brings a fresh portion of the roll behind the lens ready for the next picture. The roll is large enough for a hundred pictures, and a child can manipulate it.

The Abendroth & Root Manufacturing Company, located at 28 Cliff street, New York, manufacturers of Root's sectional safety steam boiler, have made several improvements of late in this popular steam generator, and offer it now in its latest improved form as the best type of the safety boiler. There is a steady, increasing demand for this boiler, and a large number of them are already in use in electric lighting and power stations. They are rapid steam generators, absolutely safe from explosion, and can be readily cleaned or repaired, besides being very economical in the use of fuel. The manufacturers have recently issued a handsomely illustrated catalogue, giving full particulars regarding this boiler. Write for it.

Houston's Electrical Dictionary.—To the favorable press opinions already cited may be added the following: *Milwaukee Sentinel.* "The appearance of this handsome and handy volume is timely. Electrical science is growing with great rapidity, and there has been a constant accumulation of words, terms and phrases, while the lexicons have not kept pace with the increase." *Brooklyn Eagle.* "It is an ample volume of 650 pages, with about 400 illustrations to assist in defining its 2,500 terms and phrases which are also referred, in general statement, to the principles of electrical science under which they belong. Cross references make it easy to find definitions as well as words. The book is handsomely printed."

Queen & Co., the well-known makers and importers of electrical test instruments, report rapidly increasing and encouraging sales of their large resistance boxes. Among the recent purchasers of the high-grade boxes we mention the University of Cincinnati, New York Arsenal, Lehigh University. The California Electric Light Company write in reference to one of the large No. 1 sets, Prof. Anthony's design, which they recently purchased, saying the set is simply perfection. A megohm box of special pattern, with all the metal portions mounted on corrugated pillars for most effective insulation has just been brought out. Their magnetic vane instruments, which were recently described in these columns, are very satisfactory and are now being put upon the market in large quantities. The Brush Electric Company, of New York, purchased 19 of these instruments for station work during the summer, and six more have been ordered for the new Brush plant in Minneapolis. Queen & Co. report sale during the past week of their large new standard Bunsen photometer to the Schaeffer Electric Company, of Boston. They have also gotten up a new form of portable photometer for street work.

To the Members of the National Electric Light Association.—The undersigned committee of arrangements on transportation take pleasure in announcing to the members of our association that the Burlington route, Chicago, Burlington & Quincy Railroad, has been selected as the official line to carry the delegates and their friends to the annual meeting at Kansas City, Feb. 11, 12, 13 and 14. A special Pullman vestibule train will be run through from New York City. This train will be lighted throughout with electricity, and at Chicago additional electric lighted sleepers will be added. The solid train thus formed will leave Chicago Monday, Feb. 10, 1890, at 5 P.M., arriving in Kansas City the next morning. Applications for sleeping car space in the special cars which are added at Chicago should be addressed at once to W. W. King, city passenger and ticket agent, C., B. & Q. R. R., 211 Clark street, Chicago. *Rates.*—A rate of a fare and a third for the round trip, on the certificate plan, has been obtained, certificates to be signed by Allan V. Garratt. To secure the excursion rate, tickets going should be purchased at the regular one-way rate, for which a special form of receipt will be given. On presentation of this receipt by the original holder within three days from date of the close of the meeting, at the Burlington route ticket office in Kansas City, return tickets will be sold at one-third the regular fare, provided the receipt has been properly endorsed at the meeting by Mr. Allan V. Garratt, secretary of the association. On this basis the cost for the railroad ticket for the round trip from Chicago will amount to $16.67. If lower rates than those quoted above are prevailing to Kansas City at the time of this meeting, the delegates can, of course, avail themselves of the same.

C. H. WILMERDING, Chairman,
F. E. DEGENHARDT,
W. A. KREIDLER,
} Committee.

OUR ILLUSTRATED RECORD OF ELECTRICAL PATENTS.

PATENTS ISSUED JANUARY 28, 1890.

420,057. Wind-Vane Indicator; Henry Jansen Haight, of New York, N. Y. Application filed Aug. 23, 1889. A rotary arbor, a circuit making and breaking wheel rotated thereby, an electric circuit which is opened and closed by the action of the wheel, an electric generator in the electric circuit, and a contact pin rotating with the wheel, which is in electric communication with one pole of the electric generator, the electric circuit being opened and closed by the action of the wheel between the generator and contact pin, in combination with two separated and insulated contacts, between which the contact pin is located, the insulated contacts being capable of being freely turned in either direction in arcs concentric with the arbor by the movement of the pin when it comes in contact with the contacts, respectively; and independent circuit wires in electric connection, respectively, with the insulated contacts and with the opposite pole of the electric generator.

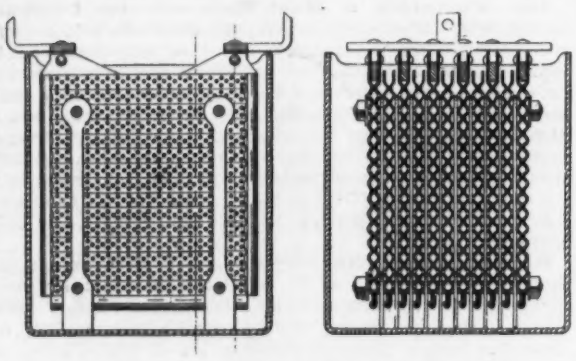
420,070. Electric Detecting Apparatus for Coin Actuated Boxes; William J. Howey, of New York, N. Y. Application filed Sept. 5, 1889. The combination of a coin actuated box with a pair of opera glasses, and connecting flexible electric guard or cord, containing a conductor, and connecting the glasses to the box, and an electric indicator in circuit with the conductor.

0,077. Incandescent Lamp Socket; Hermann Lemp, of Hartford, Conn., Assignor to the Schuyler Electric Company, of Connecticut. Application filed Dec. 17, 1888. A standard or member constituting a contact and a pair of spring actuated levers suitably fulcrumed and adapted to make contact with the standard or member at different points thereof, whereby a contact device may be entered between the standard and levers, and the contacts between the latter successfully broken in such entry and also successfully made between such parts upon withdrawal of the contact device.

420,079. Electric Reciprocating Tool; Harry N. Marvin, of Syracuse, New York. Application filed April 29, 1889. The object of the invention is to provide a system for operating a reciprocating engine that shall be simple in construction and operation and adapted to operate on the same set of wires, apparatus requiring a continuous current and apparatus requiring pulsatory currents.

420,080. Electric Reciprocating Tool; Harry N. Marvin, of Syracuse, N. Y. Application filed April 20, 1889. The combination, with a source of continous currents, of an eletromagnet reciprocating tool having two energizing currents, a switch mechanism actuated by a source of power and adapted to connect the source of continuous currents alternately with the two circuits of the tool, and rheostats or variable resistances between the tool circuits and the switch mechanism.

420,091. Testing Apparatus for Telephone Exchange Switches; Joseph John O'Connell, of Chicago, Ill. Application filed June 6, 1887. In testing apparatus for telephone exchanges, the combination, with the telephone line and its terminal, of the separate switch appliance therefor, a test battery having a ground branch, and on its opposite side being connected up with the separate switch and through it to line when such line is closed by



No. 420,234.—Plate for Secondary Batteries.

the switch for conversation, and the operator's receiver having independent switch connection with the telephone line.

420,096. Lightning Arrester; Charles A. Pfluger, of Chicago, Ill., Assignor to David P. Perry, of same place. Application filed May 27, 1889. A lightning arrester, consisting of an electromagnet with a fixed core, a supported armature in front of such magnet, provided at one end with a weight adjustable therealong and at the other with a discharge plate, a fixed discharge plate normally in close proximity to the first-mentioned discharge plate, a supporting frame on which the several parts are secured, a stop to limit the downward motion of such pivoted armature when released by the magnet, and conducting wires leading, respectively, to the ground and the wire of the line to be protected, one of such conductors connected with the fixed discharge plate, the other with the movable discharge plate through the electro-magnet.

420,101. Conduit for Electric Street Railways; Jesse Wilford Reno, of Boston, Mass., Application filed Sept. 12, 1889. In a conduit for electric railways, the clamping chair, composed of transverse vertical ribs or braces connected by centre and side pieces, which are grooved to form seats for the flanges of the girder rail and conduit casing, and for the keys or wedges by means of which the parts are connected.

420,102. Telegraphic Transmission of Index Movements; Felix Richard, of Paris, France, Assignor to the Société Richard Frères of same place. Application filed Dec. 13, 1888. In a system for telegraphically transmitting the indications of a movable index, the combination of a circuit closer at the transmitting station, in connection with the index, for transmitting an electric impulse upon the movement thereof, a line circuit operated by the circuit closer, a receiving instrument having a receiving magnet in connection with the circuit, and means for terminating the impulse over the circuit, connected to and operated by the receiving instrument, whereby when the circuit is closed or broken to transmit a movement, it is restored to its normal condition, only as a consequence of the operation of the receiving instrument.

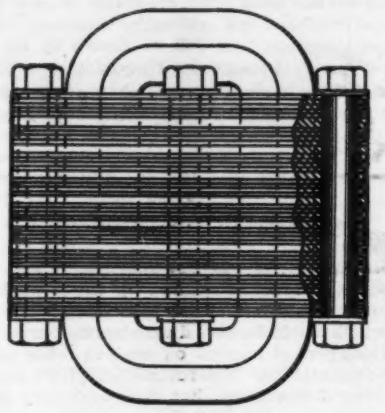
420,109. Electric Arc Lamp; Charles E. Scribner, of Chicago, Ill., Assignor to the Western Electric Company, of same place. Application filed Jan. 2, 1883. In an electric arc lamp, the combination, with an electro-magnet in the shunt of the arc and its armature, of an electro-magnet in the main circuit carried upon a movable support, the support being controlled by the armature of the electro-magnet in the shunt of the arc, whereby the position of the main circuit electro magnet and its armature is caused to vary in response to the variations in the strength of the current passing through the electro-magnet in the shunt of the arc.

420,117. Electric Motor and Regulator Therefor; Elmer A. Sperry, of Chicago, Ill. Application filed Dec. 7, 1888. In a motor, a revolving field magnet, the terminals of which are connected to contacts, in combination with a movable contact operating in conjunction therewith, and a centrifugal device which affects the movement of the contact maker, all of which revolve with the field magnet. See illustration.

420,138. Regulator for Dynamos; James J. Wood, of Brooklyn, N. Y. Application filed Oct. 12, 1889. The combination, with a dynamo regulator of the class wherein a shifting mechanism is connected in either direction to a source of power by the action of an electromotive device, of a retarding device for resisting undue movements of the mechanism connected thereto through the medium of a frictional connection adapted to slip in the case of a quick and forcible movement.

420,171. Insulating Casing; John A. Seely, of New York, N. Y. Application filed Oct. 28, 1889. The invention consists in constructing a separable or removal covering of vulcanized rubber or other suitable insulating material, which is made in the form of a separable tube, which is placed over the main or continuous wire, one of the separable parts or sections of this tube having a screw-threaded hole in its side, into which is screwed a short tube, which latter tube receives the branch wire.

420,173. Electric Fire-Alarm System; John Speicher, of Jersey City, Assignor by direct and mesne assignments to the Newark District Telegraph Company, of Newark, N. J. Application filed June 21, 1888. In an electric fire-alarm system the combination, with magnets, batteries, a repeater, fire-boxes or stations, and engine-houses, gongs or bells, all arranged on a circuit with suitable connecting wires, of a local battery opened or closed by mechanism operated by the main circuit and having



No. 420,396.—Electric Transformer.

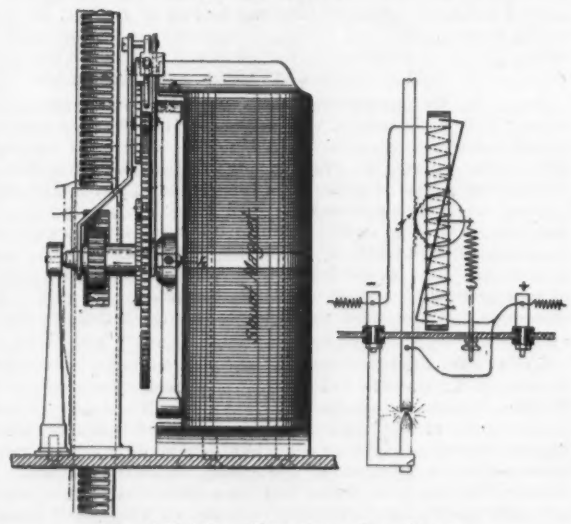
thereon a punching apparatus, a transmitter, a tower-bell circuit and a weight arranged between the transmitter and punching apparatus, keeping the tape taut, the parts being suitably arranged and combined.

420,183. Telephone Exchange Apparatus; Franklin G Beach, of Chicago, Ill., and Frank B. Cook, of Toledo, O. Application filed June 28, 1889. The switch consisting of the front portion insulated from the frame, a spring insulated from the frame and normally resting in contact with the front insulated portion, the switch lever and the contact piece upon which the lever normally rests being insulated from the frame, the lever carrying a piece of insulating material normally separated from the insulated spring, and a plug adapted to be inserted in the switch to first lift the lever from its contact and then force the piece of insulating material carried by the lever against the insulated spring to lift the said insulated spring from its normal contacts with the front portion of the switch, whereby the plug forms a momentary connection between the front portion of the switch and the frame thereof, before the insulated spring is lifted from the front portion.

420,198. Automatic Safety Cut-Off for Electric Circuits; George M. Guerrant, of New York, N. Y. Assignor to himself and H. Wise Wood, of same place. Application filed Oct. 21, 1889. The combination, with a dynamo or electric generator, and the external circuit of the shunt circuit, electro magnet, armature switch, and the branch circuit closed by the armature switch, the electro-magnet in the branch circuit, a continuously revolving mechanism brought into action by friction induced by the magnet, and a switch in the main circuit acted upon by the revolving mechanism to break the circuit.

420,214. Electric Meter; Walter F. Smith, of Philadelphia, Pa., Assignor to the United Electric Improvement Company, of Gloucester City, N. J. Application filed May 24, 1889. The invention consists in interposing between the registering mechanism and the chamber wherein the evolution of gas takes place a filtering device which prevents any acid passing over with the gas.

420,217. Ocean Signal; Walter Thompson and Alfred Gartner, of Newark, N. J. Application filed Aug. 24, 1889. The electric ocean danger signal consisting of a metallic rotating drum carrying a funnel provided with a diaphragm and metallic brush, an insulator drum provided on its outer periphery with carbon or



No. 420,314.—Electric Arc Lamp.

metallic projections, a post supporting said rotating and insulating drums and adapted to serve as a conductor from a battery, and a frame supporting the parts and an electric battery, all the parts being so arranged that when the metallic brush and the carbon projection come in contact the electric circuit will be closed.

420,234. Plate for Secondary Batteries; George A. Johnson, of Boston, Mass. Application filed Nov. 10, 1888. The composite plate formed of two plates corrugated horizontally and placed face to face, with their convexities and concavities facing each other, whereby comparatively small rod-like cavities are formed across and within the body of each composite plate, the plates being perforated with numerous small holes over each of the cavities, and inclosing in the cavities the sensitive preparation necessary to electric action, the plates being seamed together upon their sides and bottom, and provided with suitable attachments to the poles of the battery.

420,240. Printing Telegraph; James F. McLaughlin, of Philadelphia, Pa. Application filed August 29, 1889. In a printing telegraph, the combination, with an electric printing mechanism and an electric rheotome at each station controlling the printing mechanism, comprising a series of type-lever-actuating magnets arranged in a single organized machine, of a mechanically actuated rheotome at the transmitting station controlling the electrical rheotome at each station.

420,255. Electric Signal; John D. Taylor, of Piketon, O. Application filed Feb. 14, 1889. In electric signaling apparatus, the combination of the electro-magnets, the armature levers adapted to be operated by the magnets, the shaft, the ratchet-wheel mounted upon the shaft, the pawl carried by the armature lever, the contact screw inserted in the armature lever, and the line and local connections.

420,300. Therapeutic Magnet; Thomas H. Hicks, of Detroit, Mich., Assignor by direct and mesne assignments to the Therapeutic Terrestrial Equipoise Company, of Michigan. Application filed Oct. 12, 1889. In a therapeutical magnet the combination, with a magnet, of a series of metallic contacts or poles in the magnetic field thereof and in graduated proximity to the poles of the magnet, and a metallic frame supporting the magnet and series of poles in fixed relation to each other.

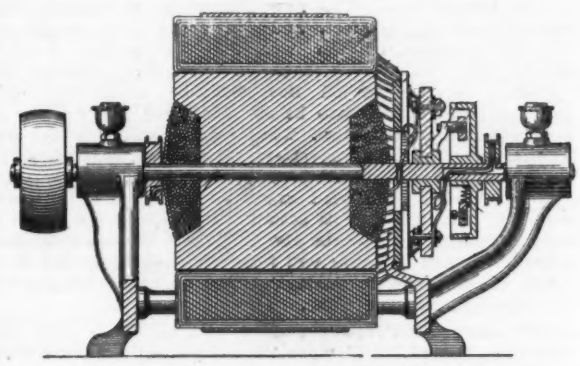
420,314. Electric Arc Lamp; Rupert Schefbauer, of New York, N. Y., Assignor of one-half to Charles Beil, of same place. Application filed Jan. 25, 1889. The combination of a main circuit, a shunt circuit, an electro-magnet located in the shunt circuit and provided with laterally-projecting segmental pole ends, a pivoted Z-shaped armature having segmental ends, arms fixed to the shaft of the armature and constituting a swinging frame, a sleeve on the shaft, a main gear wheel on the sleeve, a pinion supported in the frame, and meshing with the gear wheel, an escapement wheel on the shaft of the pinion, a weighted escapement pawl for engaging the wheel, a short arm pivoted at the upper end of the frame for engaging the pawl to hold it in contact with the escapement wheel, the arm being adapted to engage the upper pole and for releasing the pawl, an upper carbon holder provided with a rack, a pinion engaging the rack connected with the gear wheel, a lower carbon holder, and a tension device for returning the armature. See illustration.

420,334. Magnetic Separator, Gurdon Conkling, of Glens Falls, N. Y. Application filed May 29, 1889. A magnetic separator comprising an endless traveling belt, a magnet located within the belt, and a series of rollers journaled in bearings on the magnet between the ends thereof to support the belt at points along the magnet between its extremities.

420,358. Printing Instrument or Apparatus for Telegraphic or other uses; James Harris Rogers, of Bladensburg, Md., Assignor to the Visual Synchronism Company, of West Virginia. Application filed June 9, 1887. The combination of the character rods or levers provided each with its appropriate character or element of an ordinary letter or figure, by the conjoint use of two or more of which the desired letter or figure can be printed upon a strip of paper, and having their ends, which are provided with the characters or element brought closely together, so that the mark made by one may join, or nearly join, the mark made by another.

420,370. Incandescent Lamp Holder; Marie J. Wightman, of Lynn, Mass., Assignor to the Thomson-Houston Electric Company, of Conn. Application filed Oct. 9, 1889. In an electric switch, a U-shaped spring metal electrode and a supporting spindle connected therewith through parts having a lost motion.

420,384. Electrical Communicating System; Alfred G. Holcombe, of New York, N. Y., Assignor to the Electric Signal



No. 420,117.—Electric Motor and Regulator therefor.

Manufacturing Company, of same place. Application filed Jan. 14, 1889. The combination of a source of electrical energy, individual lines leading from the central to the sub-stations, signal devices interposed between the individual lines and one pole of the source of energy, a collective line to which all the individual lines run, flash lights placed between the collective line and the sub-station apparatus, and circuit connections which connect the opposite pole of the source of energy with the individual lines.

420,391. Gas Pipe Insulating Device; Edwin Wilbur Rice Jr., of Lynn, Mass. Application filed June 2, 1888. The invention consists in interposing between two sections of conducting pipe an insulating section consisting of a tube of insulating material forming a gas way or passage between the united sections, and extending beyond the insulated washer interposed between he abutting ends of the sections.

420,393. Telegraph Apparatus; Ebenezer B. Shafer, of New York, N. Y. Application filed Feb. 13, 1889. The combination of the series of toothed contact wheels positively connected to a common shaft, a branch line and brushes and circuit closer to each contact wheel branch line, the connecting bar of the main line common to all circuit closers, and the driving train connected with the contact wheel shaft through the ratchet and pawl device, and having the stop to produce any predetermined number of contacts with any one of the series of contact wheels, according as the driver is set by the ratchet.

420,396. Electric Transformer; Elihu Thomson, of Lynn, Mass. Application filed Oct. 9, 1889. The invention consists of a transformer or reactive coil, whose magnetizable core consists of a number of sheets of iron having a thin coating of some insulating substance, as varnish, combined with sheets of zinc, tin, or other non-magnetizable metal interposed between the sheets of iron at any desired intervals, the sheets or plates of zinc or tin and iron being fastened or bound together as a permanently solid core structure. See illustration.

420,398. Governor for Dynamos or Motors; Addison G. Waterhouse, of Hartford, Conn., Assignor by mesne assignments to the Schuyler Electric Company, of Conn. Application filed Sept. 24, 1885 The invention consists in combining with the field magnet two sets of coils, so arranged that if the current in one set be increased, while the current in the other is diminished or remains stationary, the field magnetism will be shifted transversely across the armature, and in placing one set of such coils in a derived circuit to the other, the armature being arranged to revolve in such relation to the pole pieces that the shifting of the magnetism by the action of the coils will be in a direction transverse to the armature.

420,422. Current-Direction Indicator; Ernest P. Warner, of Chicago, Ill., Assignor to the Western Electric Company, of same place. Application filed August 27, 1889. The invention consists in an electro-magnetic device having return poles on opposite sides of the central or main pole of the core, in combination with a permanent magnet having its polar extensions inclosing the end of the pole of the core, so that each polar extension will come between the core and one of its polar extensions, this permanent magnet being pivoted and adapted to vibrate in different directions, according to the direction of the current through the coil of the electro-magnet.

Copies of the specifications and drawings complete of any of the patents mentioned in this record—or of any other patents issued since 1866—can be had for 25 cents. Give the date and number of patent desired, and address The W. J. Johnston Co. Ltd., Times Building, N. Y.

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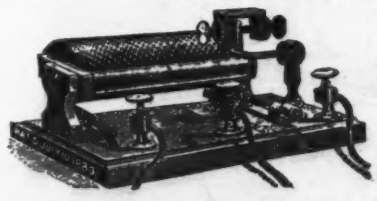

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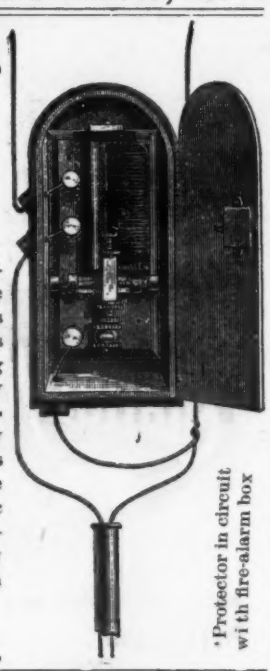

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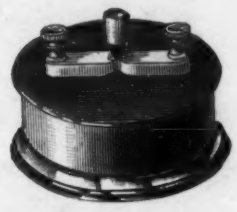

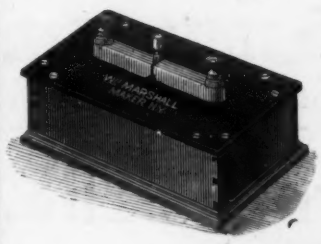

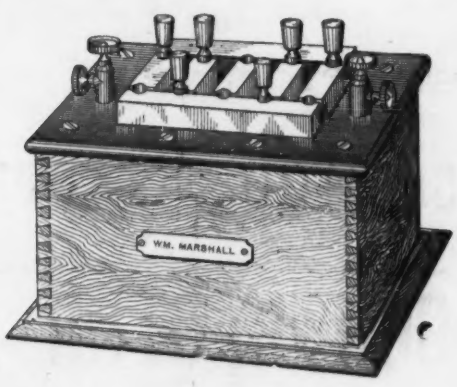

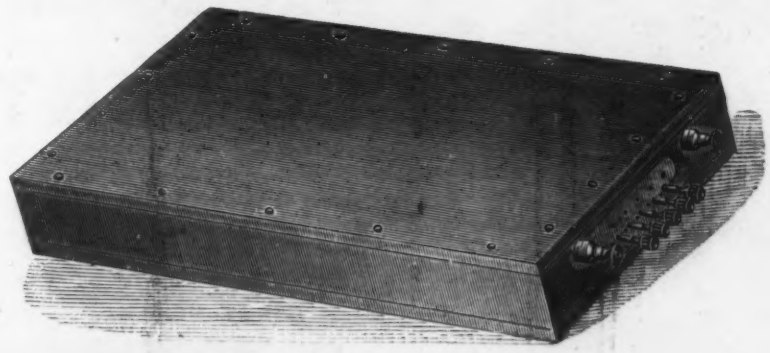

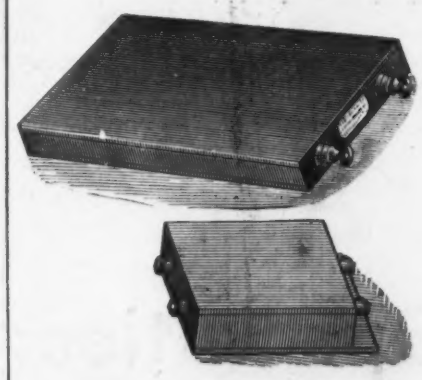

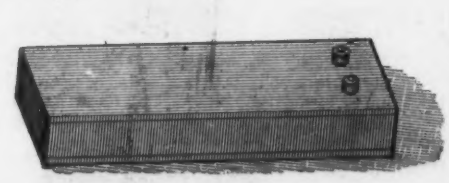

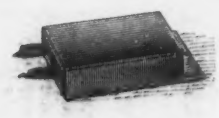

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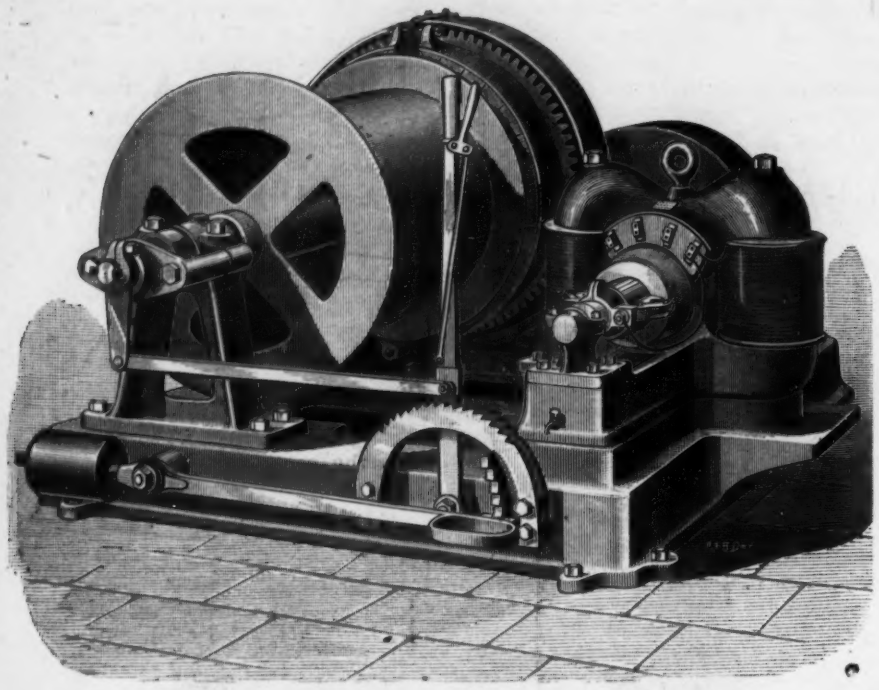

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